



SLRFLR.0009P

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	George A. Zimmerman, et al.)	Group Art Unit: 2644
Appl. No.	:	10/603,498)	
Filed	:	June 24, 2003)	
For	:	METHOD AND APPARATUS)	
		FOR PRECODE CROSSTALK)	
		MITIGATION)	
Examiner	:	Walter F. Briney III)	
<hr/>				

AFFIDAVIT OF PRIOR INVENTION UNDER 37 C.F.R. § 1.132
BY APPLICANTS' ATTORNEY, CHAD W. MILLER

I, Chad W. Miller, hereby declare as follows,

1. I am a resident of the State of Nevada, U.S.A. I make this declaration on personal knowledge, and if called on sworn as a witness, I could and would competently testify as set forth below.
2. I acknowledge that any willful false statements and the like are punishable by fine or imprisonment, or both under 18 U.S.C. § 1001 and may jeopardize the validity of the application or any patent issuing thereon.
3. All statements made herein are based on my own knowledge, are true, and all statements made on information and belief are believed to be true.
4. I am a registered patent attorney and have been retained to represent Solarflare Communications, Inc.
5. I prepared and filed U.S. Provisional Patent Application 60/424,961 entitled Method and Apparatus For Joint Equalization and Crosstalk Mitigation on November 7, 2002. The above-referenced patent application claims priority to this provisional application.
6. After preparation and review of the provisional application (attorney docket number SLRFLR.0004P and application number 60/424,961) the decision was made to file two utility applications, both of which claim priority to this provisional because of the rule against multiple inventions in one utility patent. The attorney docket numbers and application serial number for each utility application is as follows: SLRFLR.0004P, application number 10/603,417 and SLRFLR.0009P, application number 10/603,498. The fact that the subject matter for two utility

applications was contained within the one provisional application supports the conclusion that the application was long and complex.

7. I met with the inventors to obtain an invention disclosure so that I may draft the patent application. During this meeting I received information that I used to prepare the provisional patent application that evidenced that the inventors were in possession of the subject matter claimed in the above-referenced application. The Affidavits of W. Jones and G. Zimmerman, which were previously submitted, support this assertion.

8. After the invention disclosure meeting I proceeded to prepare a first draft of the provisional patent application. The provisional patent application contains support for the claimed subject matter in the above-referenced application. The provisional application has the client code SLRFLR.0004P as shown at the top of the invoice. The above-referenced application has the client code SLRFLR.0009P.

9. Exhibit A, submitted herewith, is a copy of the July 2002 invoice for services rendered to Solarflare in June, 2002. Solarflare is the employer of the Applicants and is the owner of the above-referenced application by assignment. The invoice evidences that I was in possession of the invention and working diligently on the application or other related applications during June of 2002. For the client code SLRFLR.0004P, this invoice shows that I reviewed the disclosure notes and began drafting on June 12, 2002.

10. Exhibit B, submitted herewith, is a copy of the August invoice for services rendered to Solarflare in July, 2002. The invoice evidences that I worked diligently on the application, reference number SLRFLR.0004P and other related applications for Solarflare during July of 2002.

11. Solarflare applications having reference numbers other than SLRFLR.0004P and SLRFLR.0009P were directed to the same or closely related subject matter, both claim priority to the same provisional application, and had potential bar dates. In my opinion, all of the Solarflare applications are inter-related as all Solarflare patent applications deal with signal processing to achieve high rate data communication.

12. I worked on numerous if not all of the Solarflare applications during the months of June through November. Many of the applications had bar dates that necessitated filings to prevent loss of rights, and work on these applications was closely related to and intertwined the above-referenced application. For example, on July 1, 2002, I filed a patent application (attorney docket number SLRFLR.0002P) directed to Method and Apparatus for Channel Equalization. On July 10, 2002, I also filed a patent application (attorney docket number SLRFLR.0003P) directed to a Communication System. On July 10, 2002 I also filed a patent application (attorney docket number SLRFLR.0005P) directed to a Method and Apparatus for Constellation Shaping. In addition to all these filing, I still diligently worked on the provisional patent application for

attorney docket number SLRFLR.0004P to which the above-referenced application claims priority.

13. Exhibit C, submitted herewith, is a copy of the September 2002 invoice for services rendered to Solarflare in August, 2002. The invoice evidences that I worked diligently on the provisional patent application and other related applications during August 2002. In particular, when looking at the days worked for matters relating to attorney docket numbers SLRFLR.0004P and SLRFLR.0009P, I worked on the application on the following days: August 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 20, 27, 28, and 30. The weekends are on the following days: 3, 4, 10, 11, 17, 18, 24, and 25. On the 2nd of August my time records show I was sick for most of the day.

14. As shown in Exhibit C, on August 30, 2002, I forwarded a first draft of the application to the Applicants for review and revision. Although not evidenced in an Exhibit, I maintained communication with the inventors thereafter.

15. For some reason, the Applicants did not receive the mailed copy of the application, so on September 9, 2002, I e-mailed a copy of the application to the Applicants. An e-mail is attached as Exhibit G showing that I re-transmitted the application via e-mail for review on September 9, 2002.

16. Exhibit D, attached herewith, is a copy of the provisional application as sent to the Applicants for review. The draft application contained numerous blanks, questions, and sections that needed substantial review and supplementing by the Applicants. Reviewing the draft applications was not standard, in that the Applicants were not simply reading through a polished application and signing off.

17. As shown in the draft patent application in Exhibit D, the Application contains comments, request for help, or blanks to be filled in on pages 4, 14, 15, 16, 20, 24, 25, 26, and 28. To further support the extent of the review and changes and show that the Applicants were diligent in their substantial review, Applicants made changes to the draft on pages 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, 27, 28, 30, 33, 36, 37 out of 37 pages total. It is clear that substantial effort was required by the Applicants to complete their review. Thus, it is my opinion that the Applicants made substantial changes and for the Applicants to have completed the review, testing, revisions, and discussion before November 7, 2002 they would have had to work diligently.

18. Exhibit E, attached herewith, is a copy of the October invoice for services performed for Solarflare during September, 2002. During this period, at least one of the Applicants was occupied reviewing another application. In particular, on 9/9/02 for attorney docket number SLRFLR.0006P, a related application, I e-mailed W. Jones another application for review. On 9/17/02 I conducted a conference call with W. Jones regarding changes/clarification to this application. This evidences that W. Jones was diligently working on related patent matters, in

addition to his review of the provisional application to which the above-referenced application claim priority. It is my opinion that these two applications are closely related.

19. During October 2002 I had numerous conference calls with the Applicants regarding the required changes in the provisional patent application. As a rule, I do not bill for such calls because such calls result from my lack of understanding regarding the subject matter, or from errors I have made in the application. I treat such calls as part of learning the technology, which I consider non-billable. Review of the invoices submitted in Exhibits evidence that I do not charge for such work.

20. Based on my numerous conversations with the Applicants during September and October of 2002, Applicants were clearly diligent in reviewing the provisional patent application.

21. During September and October of 2002 I was busy working on other related applications for Solarflare. Exhibit F, attached herewith, is the November 2002 invoice for services performed during October 2002 for Solarflare. This invoice evidences that I was working, almost daily, on attorney docket numbers SLRFLR.0007P, SLRFLR.0010P, and SLRFLR.0011P. The projects hindered my ability to interface with the Applicants which slowed the review by the Applicants of the provisional application. This delay is excusable because I was working on projects in chronological order and based on deadlines imposed by Solarflare's disclosure schedule.

22. Exhibit H, attached herewith, is a copy of the December 2002 invoice for services performed for Solarflare during November, 2002. This invoice shows that I diligently worked on Solarflare matters during November and that the provisional application was filed on November 7, 2002.

23. Exhibit I, attached herein, is a copy of all of billed time entries that were sent out to client for payment. These entries are for the time period of September 1, 2002 to October 31, 2002. This list does not include vacation days, sick days, non-billable time, CLE, or pro bono work. I have redacted the attorney docket numbers on non-Solarflare matters to protect attorney-client privilege.

24. This list of a time entries in Exhibit I provides evidence that I was busy with numerous client matters during this time period and this level of work hindered my ability to interface with the Applicants. Although the Applicants attempted the schedule time to address and discuss the first draft of the provisional patent application, I often had to delay the conference calls to address my other work load in chronological order and to address bar dates. The projects I was working on were approached in chronological order and through no lack of diligence on my behalf or the Applicants behalf, hindered my ability to advance the Applicants' review of the provisional patent application.

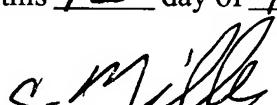
25. As shown in Exhibit H, in the attorney docket numbers SLRFLR.0001G and SLRFLR.0004P file on November 4th I reminded the Applicants regarding a potential foreign filing bar and received the revised application from the Applicants on November 5th.

26. On November 6th, I worked with my secretary to gather the information needed for filing of a provisional application and on November 7th, as evidenced by the filing date of the provisional application, I filed the provisional application to which this application claims priority.

27. From this evidence it is clear that the Applicants and I were reasonably diligent in the preparation of the patent application between the relevant dates of June 7, 2002 and November 7, 2002. It is my opinion and belief that the attached documents provided as Exhibits herewith and this sworn Affidavit provides evidence of reasonable diligence between the dates of June 7, 2002 and

28. I declare under Penalty of Perjury under the laws of the United States of America that the forgoing is true and correct.

Executed this 12 day of April, 2006.

By: 
Chad W. Miller

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: July 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**
To: **Subject Matter: General Intellectual Property Representation**

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
6/25/02	CWM	Conference W. Jones regarding status of cases and scheduling of upcoming disclosures	0.40 220.00/hr	88.00
6/30/02	CWM	Prepare scheduling report document	0.20 220.00/hr	44.00
			<hr/>	<hr/>
For professional services rendered			0.60	\$132.00
Previous balance				\$22.00
7/3/02 Payment - thank you. Check No. 1571				(\$22.00)
			<hr/>	<hr/>
Total payments and adjustments				(\$22.00)
			<hr/>	<hr/>
Balance due				\$132.00
			<hr/>	<hr/>

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0002P**
Subject Matter: Patent Prosecution
Title: Transmission Line Equalization
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
6/5/02	CWM	Review inventor changes to application; revise application	1.60 220.00/hr	352.00
6/6/02	CWM	Review and revise claims based on comments from W. Jones	2.20 220.00/hr	484.00
6/7/02	CWM	Draft claims	2.50 220.00/hr	550.00
6/10/02	CWM	Continue drafting claims	4.20 220.00/hr	924.00
6/14/02	CWM	Make final changes to application and forward same to B. Jones	1.30 220.00/hr	286.00
6/19/02	CWM	Review e-mail from W. Jones with second draft of application attached; confer with W. Jones regarding same	0.20 220.00/hr	44.00
6/20/02	CWM	Review e-mail with attachment from W. Jones; review changes and formatting and initiate preparation of formal papers	0.30 220.00/hr	66.00
6/24/02	CWM	Prepare formal papers	0.80 220.00/hr	176.00
For professional services rendered			<hr/>	<hr/>
			13.10	\$2,882.00
Previous balance				\$1,166.00
7/3/02	Payment - thank you. Check No. 1571			<hr/>
				(\$1,166.00)
Total payments and adjustments				<hr/>
				(\$1,166.00)
Balance due				<hr/>
				\$2,882.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**
 To: **Subject Matter: Patent Prosecution**
 Title: Communication System
 Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>		
6/11/02	CWM	Review existing claims and draft additional claims	2.60 220.00/hr	572.00		
6/13/02	CWM	Draft summary and make minor revisions to claims and detailed description	1.10 220.00/hr	242.00		
6/14/02	CWM	Perform final changes to application and forward same to B. McClellan	0.90 220.00/hr	198.00		
6/24/02	CWM	Prepare formal papers	0.80 220.00/hr	176.00		
6/30/02	CWM	Revise specification and figures based on new details provided by B. McClellan during meeting	0.80 220.00/hr	176.00		
For professional services rendered			6.20	\$1,364.00		
Previous balance				\$7,942.00		
7/3/02	Payment - thank you. Check No. 1571			(\$7,942.00)		
Total payments and adjustments				(\$7,942.00)		
Balance due				\$1,364.00		

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0004P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
6/12/02	CWM	Review disclosure notes and prior art	1.10 220.00/hr	242.00
6/19/02	CWM	Review disclosure notes and outline application	2.30 220.00/hr	506.00
6/20/02	CWM	Draft Background section	1.40 220.00/hr	308.00
6/21/02	CWM	Review disclosure notes and tape; create figures	4.50 220.00/hr	990.00
6/23/02	CWM	Draft figures and review disclosure notes	2.20 220.00/hr	484.00
			<hr/>	<hr/>
For professional services rendered			11.50	\$2,530.00
Previous balance			\$682.00	
7/3/02 Payment - thank you. Check No. 1571			<hr/> (\$682.00)	
Total payments and adjustments			<hr/> (\$682.00)	
			<hr/>	<hr/>
Balance due			\$2,530.00	

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0005P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Constellation Shaping
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>		
6/10/02	CWM	Review and revise application and figures; divide cases	3.20 220.00/hr	704.00		
6/11/02	CWM	Review existing claims and draft additional claims	1.80 220.00/hr	396.00		
6/12/02	CWM	Draft claims	2.20 220.00/hr	484.00		
6/14/02	CWM	Perform final changes to application and forward same to B. McClellan	2.40 220.00/hr	528.00		
6/23/02	CWM	Make changes to application as requested by B. McClellan	1.60 220.00/hr	352.00		
6/24/02	CWM	Prepare formal papers	0.80 220.00/hr	176.00		
6/25/02	CWM	Conference with B. McClellan regarding new subject matter to be included in specification regarding encoding of control codes	1.00 220.00/hr	220.00		
For professional services rendered			13.00	<u>\$2,860.00</u>		
Previous balance				<u>\$2,464.00</u>		
7/3/02	Payment - thank you. Check No. 1571			<u>(\$2,464.00)</u>		
Total payments and adjustments				<u>(\$2,464.00)</u>		
Balance due				<u>\$2,860.00</u>		

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**
To: **Subject Matter: Patent Prosecution**
 Title: Multiple Channel Interference Cancellation
 Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
6/24/02	CWM	Prepare for meeting by reviewing invention disclosure form and other technical references	0.60 220.00/hr	132.00
6/25/02	CWM	Conference with W. Jones at SolarFlare offices to obtain invention disclosure; prepare for same	3.60 220.00/hr	792.00
For professional services rendered			4.20	\$924.00
Balance due				\$924.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**
To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Communication System Constellation Shaping Serial No.: Not yet assigned

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
6/25/02	CWM	0.70 220.00/hr	154.00
			<hr/>
For professional services rendered			0.70
			<hr/>
Balance due			\$154.00
			<hr/>

Weide & Miller, Ltd.

330 South 3rd Street

Suite 1130

Las Vegas, NV 89101

Voice: 702-382-4804

Facsimile: 702-382-4805

Date Generated/Mailed: July 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.

9501 Jeronimo Road, Suite 100

Irvine CA 92618

In Reference Weide & Miller Ref. No.: SLRFLR.0001G

To: Subject Matter: General Intellectual Property Representation

New Fees	New Costs	Total New Charges
\$132.00	\$0.00	\$132.00

In Reference Weide & Miller Ref. No.: SLRFLR.0002P

To: Subject Matter: Patent Prosecution

Title: Transmission Line Equalization

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$2,882.00	\$0.00	\$2,882.00

In Reference Weide & Miller Ref. No.: SLRFLR.0003P

To: Subject Matter: Patent Prosecution

Title: Communication System

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$1,364.00	\$0.00	\$1,364.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0004P

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$2,530.00	\$0.00	\$2,530.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0005P

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Constellation Shaping

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$2,860.00	\$0.00	\$2,860.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0006P

Subject Matter: Patent Prosecution

Title: Multiple Channel Interference Cancellation

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$924.00	\$0.00	\$924.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0007P

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Communication System Constellation Shaping

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$154.00	\$0.00	\$154.00

Summary For All Matters:	\$10,846.00	\$0.00	\$10,846.00
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GRAND TOTAL OF ALL AMOUNTS DUE:	\$10,846.00
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Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: August 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**
To: **Subject Matter: General Intellectual Property Representation**

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/1/02	CWM	Update status report	0.20 220.00/hr	44.00
7/9/02	CWM	Conference with W. Jones regarding Consultant agreement; review same	0.50 220.00/hr	110.00
7/10/02	CWM	Draft e-mail providing opinion of current status of Consultant's Agreement and propose format for consultant to complete agreement	1.00 220.00/hr	220.00
For professional services rendered			1.70	\$374.00
Previous balance				\$132.00
8/4/02	Payment - thank you. Check No. 1644			(\$132.00)
Total payments and adjustments				(\$132.00)
Balance due				\$374.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**
 To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/1/02	CWM	File patent application with Patent and Trademark Office; prepare transmittal and review same	1.00 220.00/hr	220.00
7/3/02	CWM	Draft letter to client enclosing filed application; initiate preparation of document binder	0.20 220.00/hr	44.00
			1.20	\$264.00

For professional services rendered

Additional Charges :

7/1/02	U.S. Patent and Trademark Office Filing Fee (small entity)	595.00
	U.S. Patent and Trademark Office Assignment Recordation Fee	40.00
		\$635.00
		\$899.00
		\$2,882.00
8/4/02	Payment - thank you. Check No. 1644	(\$2,882.00)
		(\$2,882.00)
		\$899.00

Balance due

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**
 To: **Subject Matter: Patent Prosecution**
 Title: Communication System
 Serial No.: 10/194,775

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/10/02	CWM	Oversee and review transmittal; file patent application	1.00 220.00/hr	220.00
7/16/02	CWM	Draft and send letter enclosing filed patent application	0.10 220.00/hr	22.00
			<hr/>	<hr/>
For professional services rendered			1.10	\$242.00

Additional Charges :

7/10/02	Assignment Recordation Fee	40.00
	U.S. Patent and Trademark Office Filing Fee (small entity)	526.00
		<hr/>
	Total costs	\$566.00
		<hr/>
	Total amount of this bill	\$808.00
		<hr/>
	Previous balance	\$1,364.00
8/4/02	Payment - thank you. Check No. 1644	<hr/>
	Total payments and adjustments	(\$1,364.00)
		<hr/>
	Balance due	\$808.00
		<hr/>

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**
 To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/4/02	CWM	Draft patent application	2.70 220.00/hr	594.00
7/5/02	CWM	Draft patent application and update figures	4.60 220.00/hr	1,012.00
7/7/02	CWM	Draft patent application	2.80 220.00/hr	616.00
7/30/02	CWM	Conference with G. Zimmerman and W. Jones to obtain follow-up information; prepare for same	1.40 220.00/hr	308.00
For professional services rendered			<hr/> 11.50	<hr/> \$2,530.00
Previous balance				\$2,530.00
8/4/02	Payment - thank you. Check No. 1644			(\$2,530.00)
Total payments and adjustments				<hr/> (\$2,530.00)
Balance due				<hr/> \$2,530.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0005P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Constellation Shaping
Serial No.: 10/194,741

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/1/02	CWM	Review and revise application and figures; draft e-mails to B. McClellan attaching final draft of patent application	3.60 220.00/hr	792.00
7/3/02	CWM	Review e-mail from B. McClellan and conduct call with B. McClellan; revise application accordingly	2.70 220.00/hr	594.00
7/5/02	CWM	Draft portion of additional claim set based on e-mail from B. McClellan	1.80 220.00/hr	396.00
7/8/02	CWM	Draft additional claims set and confer with B. McClellan regarding same; send revised claim set to B. McClellan; review e-mail approving same	2.40 220.00/hr	528.00
7/10/02	CWM	Review transmittal; oversee filing of patent application	1.00 220.00/hr	220.00
7/16/02	CWM	Draft and send letter enclosing filed patent application	0.10 220.00/hr	22.00
For professional services rendered			<hr/> 11.60	<hr/> \$2,552.00

Additional Charges :

7/10/02 Assignment Recordation Fee	40.00
U.S. Patent and Trademark Office Filing Fee (small entity)	637.00
 Total costs	 \$677.00
 Total amount of this bill	 \$3,229.00
Previous balance	\$2,860.00
8/4/02 Payment - thank you. Check No. 1644	(\$2,860.00)
 Total payments and adjustments	 (\$2,860.00)

	<u>Amount</u>
Balance due	<u>\$3,229.00</u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**
 To: **Subject Matter: Patent Prosecution**
 Title: Multiple Channel Interference Cancellation
 Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>		
7/15/02	CWM	Review disclosure and draft background and portion of detailed description	3.00 220.00/hr	660.00		
7/16/02	CWM	Revise and supplement figures	0.60 220.00/hr	132.00		
7/17/02	CWM	Draft patent application and revise figures	2.70 220.00/hr	594.00		
7/18/02	CWM	Draft patent application	3.30 220.00/hr	726.00		
7/19/02	CWM	Continue drafting patent application	5.20 220.00/hr	1,144.00		
7/23/02	CWM	Revise figures	0.90 220.00/hr	198.00		
7/25/02	CWM	Draft patent application and revise figures	2.80 220.00/hr	616.00		
7/26/02	CWM	Draft patent application	2.70 220.00/hr	594.00		
For professional services rendered			21.20	<u>\$4,664.00</u>		
Previous balance				\$924.00		
8/4/02	Payment - thank you. Check No. 1644			(\$924.00)		
Total payments and adjustments				<u>(\$924.00)</u>		
Balance due				<u>\$4,664.00</u>		

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**
To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Bandwidth Enhancement of Transformers
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/30/02	CWM	Conference with inventors to obtain invention disclosure; prepare for meeting by reviewing prior information provided by inventors	2.80 220.00/hr	616.00
For professional services rendered			2.80	\$616.00
Previous balance				\$154.00
8/4/02	Payment - thank you. Check No. 1644			(\$154.00)
Total payments and adjustments				(\$154.00)
Balance due				\$616.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0008P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Cancellation Using Mixed Signal Processing
 Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
7/28/02	CWM	Draft portion of application dealing with second embodiment	2.70 220.00/hr	594.00
7/29/02	CWM	Continue drafting portion of application dealing with second embodiment	3.80 220.00/hr	836.00
7/30/02	CWM	Conference with B. Jones to obtain follow-up information; prepare for meeting	1.30 220.00/hr	286.00
For professional services rendered			7.80	<u><u>\$1,716.00</u></u>
Balance due				<u><u>\$1,716.00</u></u>

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Date Generated/Mailed: August 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0001G**
Subject Matter: General Intellectual Property Representation

New Fees	New Costs	Total New Charges
\$374.00	\$0.00	\$374.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0002P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

New Fees	New Costs	Total New Charges
\$264.00	\$635.00	\$899.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0003P**
Subject Matter: Patent Prosecution
Title: Communication System
Serial No.: 10/194,775

New Fees	New Costs	Total New Charges
\$242.00	\$566.00	\$808.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation
 Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$2,530.00	\$0.00	\$2,530.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Constellation Shaping
 Serial No.: 10/194,741

New Fees	New Costs	Total New Charges
\$2,552.00	\$677.00	\$3,229.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**
To: **Subject Matter: Patent Prosecution**
 Title: Multiple Channel Interference Cancellation
 Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$4,664.00	\$0.00	\$4,664.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Bandwidth Enhancement of Transformers
 Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$616.00	\$0.00	\$616.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0008P

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Cancellation Using Mixed Signal Processing

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$1,716.00	\$0.00	\$1,716.00

Summary For All Matters:

\$12,958.00	\$1,878.00	\$14,836.00
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GRAND TOTAL OF ALL AMOUNTS
DUE:

\$14,836.00

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MILLER, Ltd.

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On the web: www.WeideMiller.com

CHAD W. MILLER
REGISTERED PATENT ATTORNEY
LICENSED IN CALIFORNIA & NEVADA

September 12, 2002

Mr. Ben Charny
Executive Vice President and CFO
SolarFlare Communications, Inc.
9501 Jeronimo Rd., Suite 100
Irvine, CA 92618

Re: Invoice for September 2002

Dear Ben:

Enclosed is the invoice for September 2002. We apologize for its lateness. At the beginning of the month, we notified George Zimmerman of the total amount due.

Best Regards,



Chad W. Miller

Enclosure

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: September 12, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**
To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
8/11/02	CWM	Perform review of file and previous drafts as standard procedure to remove prior drafts or notes	0.10 220.00/hr	NO CHARGE
8/21/02	RBR	Draft request for corrected filing receipt.	0.50 120.00/hr	60.00
8/22/02	CWM	Draft letter enclosing filing receipt	0.10 220.00/hr	22.00
8/29/02	CWM	File request for corrected filing receipt	0.10 220.00/hr	22.00
For professional services rendered			<hr/> 0.80	<hr/> \$104.00
Previous balance				\$899.00
9/5/02	Payment - thank you. Check No. 1726			(\$899.00)
Total payments and adjustments				(\$899.00)
Balance due				<hr/> \$104.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**
(To: **Subject Matter: Patent Prosecution**
 Title: Communication System
 Serial No.: 10/194,775

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
8/29/02	RBR Draft client letter regarding USPTO receipt of patent application.	0.30 120.00/hr	36.00
		<hr/>	<hr/>
	For professional services rendered	0.30	\$36.00
		<hr/>	<hr/>
9/5/02	Payment - thank you. Check No. 1726	(\$808.00)	<hr/>
		<hr/>	<hr/>
	Total payments and adjustments	(\$808.00)	<hr/>
		<hr/>	<hr/>
	Balance due	\$36.00	<u><u>\$36.00</u></u>
		<hr/>	<hr/>

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**
 To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>		
8/7/02	CWM	Review second disclosure tape; revise figures; revise background	4.20 220.00/hr	924.00		
8/9/02	CWM	Review prior art in relation to Figure 8	0.40 220.00/hr	NO CHARGE		
8/11/02	CWM	Review prior art for reference system of Figure 8; draft introductory portion for precode FEXT cancellation system	0.60 220.00/hr	132.00		
8/14/02	CWM	Draft claims direct to communication system and receiver; draft e-mail to G. Zimmerman and W. Jones requesting information	3.90 220.00/hr	858.00		
8/16/02	CWM	Continue drafting claims	5.40 220.00/hr	1,188.00		
8/27/02	CWM	Review and revise patent application	1.40 220.00/hr	308.00		
8/28/02	CWM	Review and revise claims	0.60 220.00/hr	132.00		
8/30/02	CWM	Review and revise application; send to client	0.70 220.00/hr	154.00		
For professional services rendered			17.20	<u><u>\$3,696.00</u></u>		
Previous balance				<u><u>\$2,530.00</u></u>		
9/5/02	Payment - thank you. Check No. 1726			<u><u>(\$2,530.00)</u></u>		
Total payments and adjustments				<u><u>(\$2,530.00)</u></u>		
Balance due				<u><u>\$3,696.00</u></u>		

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Constellation Shaping
 Serial No.: 10/194,741

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
8/22/02	RBR	Draft letter to client indicating receipt of Filing Receipt.	0.50 120.00/hr	60.00
	CWM	Draft request for corrected filing receipt	0.20 220.00/hr	44.00
			<hr/>	<hr/>
For professional services rendered			0.70	\$104.00
Previous balance				\$3,229.00
9/5/02 Payment - thank you. Check No. 1726				(\$3,229.00)
Total payments and adjustments				(\$3,229.00)
			<hr/>	<hr/>
Balance due			\$104.00	_____

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**
To: **Subject Matter: Patent Prosecution**
Title: Multiple Channel Interference Cancellation
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
8/30/02	CWM	Review and revise background and first three figures and associated text	1.80 220.00/hr	396.00
			<hr/>	<hr/>
		For professional services rendered	1.80	\$396.00
		Previous balance		\$4,664.00
9/5/02		Payment - thank you. Check No. 1726		(\$4,664.00)
			<hr/>	<hr/>
		Total payments and adjustments		(\$4,664.00)
			<hr/>	<hr/>
		Balance due		\$396.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0009P**
 To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Noise Cancellation Based on Transmitter Processing
 Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
8/8/02	CWM	Revise and supplement patent application	4.60 220.00/hr	1,012.00
8/12/02	CWM	Draft patent application; draft additional figure	4.30 220.00/hr	946.00
8/13/02	CWM	Draft patent application; create figures for method of operation and draft associated text	4.20 220.00/hr	924.00
8/15/02	CWM	Draft claims	2.60 220.00/hr	572.00
8/18/02	CWM	Draft claims	2.60 220.00/hr	572.00
8/20/02	CWM	Draft claims directed to FEXT cancellation in transmitter	3.80 220.00/hr	836.00
8/27/02	CWM	Review and revise patent application	3.70 220.00/hr	814.00
8/28/02	CWM	Review and revise claims	1.70 220.00/hr	374.00
8/30/02	CWM	Review and revise application; draft letter to client enclosing same	1.60 220.00/hr	352.00
For professional services rendered			29.10	\$6,402.00

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Voice: 702-382-4804

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Date Generated/Mailed: September 12, 2002

Invoice submitted to: SolarFlare Communications, Inc.

9501 Jeronimo Road, Suite 100

Irvine CA 92618

In Reference Weide & Miller Ref. No.: SLRFLR.0002P

To: Subject Matter: Patent Prosecution

Title: Method and Apparatus for Channel Equalization

Serial No.: 10/188,274

New Fees	New Costs	Total New Charges
\$104.00	\$0.00	\$104.00

In Reference Weide & Miller Ref. No.: SLRFLR.0003P

To: Subject Matter: Patent Prosecution

Title: Communication System

Serial No.: 10/194,775

New Fees	New Costs	Total New Charges
\$36.00	\$0.00	\$36.00

In Reference Weide & Miller Ref. No.: SLRFLR.0004P

To: Subject Matter: Patent Prosecution

Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$3,696.00	\$0.00	\$3,696.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0005P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Constellation Shaping
Serial No.: 10/194,741

New Fees	New Costs	Total New Charges
\$104.00	\$0.00	\$104.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0006P**
Subject Matter: Patent Prosecution
Title: Multiple Channel Interference Cancellation
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$396.00	\$0.00	\$396.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0009P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Noise Cancellation Based on Transmitter Processing
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$6,402.00	\$0.00	\$6,402.00

Summary For All Matters: \$10,738.00 \$0.00 \$10,738.00

GRAND TOTAL OF ALL AMOUNTS
DUE: \$10,738.00

**METHOD AND APPARATUS FOR
EQUALIZATION AND CROSSTALK MITIGATION**

INVENTORS

5

GEORGE A. ZIMMERMAN

WILLIAM W. JONES

1. Field of the Invention.

The invention relates to communication systems and, in particular, to a
10 method and apparatus for equalization and crosstalk mitigation.

2. Related Art.

Modern communication systems achieve data communication between
transceivers located at remote locations. To increase data communication rates,
15 communication system cabling arrangements often include numerous conductors in
close proximity to transport a signal between remote locations. These systems may be
referred to as multi-channel communication systems. Furthermore, communication
devices are often constructed on circuit boards containing numerous conductors,
traces, or electrical devices. In all of these instances, coupling between channels of a
20 multi-channel communication systems may occur thereby introducing interference
into the other channels. This type of interference is generally referred to as crosstalk.

As is commonly understood, crosstalk may be characterized as near end
crosstalk (NEXT) and far end crosstalk (FEXT), depending on the type of crosstalk
that is introduced and the reference point from which analysis occurs. Figure 1

illustrates an example transceiver system and NEXT and FEXT coupling. As shown a first set of transceivers 104A-104D are part of Station A 102, which is located at a first location. Station A 102 communicates over a channels 108A-108D with a second set of transceivers 112A-112D that are part of Station B 110 and which are 5 located at a second location. NEXT type crosstalk is shown in Figure 1 by coupling lines 116AB, 116AC, and 116AD with channel 108A as a reference channel. Signals on each of the adjacent channels often couple into the reference channel 108A and thereby interfere with reception of the desired signal. For example, the signal on channel 108A will have NEXT coupling from the signals transmitted onto Channels 10 108B-108D.

Similarly, the signal transmitted over the reference channel 108A may couple onto the other channels 108B-108D. These coupling signals are shown in Figure 1 as coupling signals 120BA, 120CA, and 120DA. Hence, the processing and decoding of the signals transmitted over channels 108A-108D is made more difficult by the 15 coupling that occurs between channels.

While attempts have been made to overcome the effects of coupling, none of these attempts adequately reduce the presence or effects of crosstalk. One such attempt is detailed in U.S. Patent No. 6,236,645 issued to Agazzi. The Agazzi reference teaches a cancellation system associated with each receiver in a multi- 20 receiver system. The cancellation system disclosed in the Agazzi reference may be characterized as utilizing tentative decisions to reduce the effects of coupling onto a reference signal by making assumptions about the reference signal, such as a symbol value, that was sent on the reference channel. The term reference signal and reference

channel as used herein means the signal or channel which is being analyzed, discussed or which is undergoing processing. Any channel within a multi-channel communication system may be designated the reference channel. The tentative decision may be described as a guess regarding a symbol value that was sent on the 5 channel.

The Agazzi reference does not however, eliminate all of the coupling, and hence, even when adopting the teachings of the Agazzi reference, coupling continues to interfere with isolation of the received signal. One particular drawback to the teachings of the Agazzi reference is that the system of the Agazzi reference suffers 10 from decision device error resulting from crosstalk corruption of the reference signal. As a result, incorrect decision may occur thereby increasing error rates. Further, the filter proposed for use by the Agazzi reference is undesirably complex due to convolution of the channel response with the coupling response. This undesirably limits processing speeds.

15 Furthermore, prior art solutions often do not address many aspects of coupling signal cancellation. Such aspects include coupling that occurs at frequencies that differ from that of the primary signal and signals that couple into the reference signal yet propagate through the reference channel at rates different from that of the reference signal.

20 The method and apparatus disclosed herein overcomes the drawbacks of the prior art and enables more accurate signal decoding and processing than previously possible. Moreover, transmission at higher data rates with lower error rate, as compared to the prior art, is also enabled.

SUMMARY

[I will draft the summary after receiving feedback on the other portions of the application]

5 **Insert 1 - Last Paragraph of Summary:**

Other systems, methods, features and advantages of the invention will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the 10 scope of the invention, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. In the figures, like 15 reference numerals designate corresponding parts throughout the different views.

Figure 1 illustrates a block diagram of an example embodiment of a two station communication system.

Figure 2 illustrates a block diagram of a receiver/transmitter pair.

Figure 3 illustrates a block diagram of an example embodiment a multi-channel 20 point-to-point communication system.

Figure 4 illustrates a block diagram of an example embodiment of a transmitter.

Figure 5 illustrates a block diagram of an example embodiment of a receiver.

Figure 6 illustrates a block diagram of an example embodiment of the receiver shown in Figure 5 in a multi-channel configuration.

Figure 7 illustrates a block diagram of an alternative embodiment of a FEXT cancellation and equalization system described herein.

5 Figure 8A illustrates a block diagram of a receiver having a precode system for coupling cancellation.

Figure 9 illustrates a block diagram of an alternate embodiment of a receiver having a precode system for coupling cancellation.

Figures 10A & 10B illustrate operational flow diagrams of an example method
10 of operation.

Detailed Description

In reference to Figure 2, a block diagram of a receiver/transmitter pair is shown. A channel 212 connects a first transceiver 230 to a second transceiver 234. The first transceiver 230 connects to the channel 212 via an interface 244. The 5 interface 244 is configured to isolate the incoming and outgoing signals. The channel 212 may comprise more than one conductor and hence the interface 244 may perform isolation for each channel based on direction of data flow. The receive module 238 and transmit module 242 may comprise any assembly of hardware, software, or both configured to operate in accordance with the principles described herein.

10 The receive module 238 and transmit module 242 communicate with a processor 246. The processor 246 may include or communicate with a memory 250. The processor operates as described below in more detail and as would be understood by one of ordinary skill in the art. The memory 250 may comprise one or more of the following types of memory: RAM, ROM, hard disk drive, flash memory, or EPROM. 15 The processor 246 may be configured to perform one or more calculations or signal analysis. In one embodiment the processor 246 is configured to execute machine readable code stored on the memory 250. The processor 246 may perform additional signal processing tasks as described below.

The second transceiver 234 is configured similarly to the first transceiver 230. 20 The second transceiver 234 comprises an interface 252 connected to a receiver module 256 and a transmitter module 260. The receiver module 256 and a transmitter module 260 communicate with a processor 264, which in turn connects to a memory 268. Operation occurs as described below in more detail.

Figure 3 illustrates a block diagram of an exemplary multi-channel point-to-point communication system. One exemplary application of such as multi-channel communication system is a ten gigabit transceiver utilizing a Category 5 UTP cable supporting Ethernet protocols. As shown, it includes a physical coding sublayer (PCS) 302, 304 shown as coupled together over a channel 312. In one embodiment, each channel comprises twisted pair conductors. Each of the channels 312 is coupled between transceiver blocks 320 through a line interface 306 and each channel is configured to communicate information between transmitter/receiver circuits (transceivers) and the physical coding sublayer (PCS) blocks 302, 304. Although 10 shown with four channels for purposes of discussion, any number of channels and associated circuitry may be provided. In one embodiment, the transceivers 320 are capable of full-duplex bi-directional operation. In one embodiment, the transceivers 320 operate at an effective rate of about 2.5 Gigabits per second.

Figure 4 illustrates a block diagram of an example embodiment of a 15 transmitter. This is but one exemplary embodiment of a transmitter. It is contemplated that other configurations may be embodied by one of ordinary skill in the art. In the exemplary configuration of Figure 4, a data source 400 connects to a mapping module 404, which in turn connects to a precode filter 408.

The data source 400 may comprise any source of data to be transmitted over a 20 channel. In one embodiment, the data source 400 comprises a processing or networking layer of a communication protocol. In one embodiment, the data source 400 comprises a network processing device. In one embodiment, the data arrives from application software executing on a computer.

The mapping module 404 comprises hardware, software, or a combination of both configured to transform the received binary data into one or more symbols capable or representing one or more bits of binary data. One example mapping that may occur is pulse amplitude modulation (PAM), wherein the several bits of binary 5 data are mapped into a single symbol. Another example of mapping comprises quadrature amplitude modulation (QAM). Any type mapping may be utilized. Through mapping, transmission of a single symbol achieves transmission of several bits of information thereby increasing data transfer rates.

In addition to mapping, the mapping module 404 may incorporate forward 10 error correction (FEC) coding. Examples of FEC coding comprise convolutional coding and trellis coding. It is contemplated that the method and apparatus described herein may be utilized with any form of error correction, or without error correction.

The precode filter 408, which is discussed below in greater detail, connects to the output of the mapping module 404 and comprises a signal modification device 15 configured to manipulate the signal to counter the distorting effects of the channel. The precode filter 408 may be configured as a digital filter having coefficient values set to achieve a desired level of signal modification. In one embodiment the precode filter 308 comprises a finite impulse response filter adapted to at least partially negate the distorting effects of a channel. Selection of precode filter coefficients is discussed 20 below in more detail.

The output of the precode filter 408 connects to a digital to analog (D/A) converter 412 to transform the mapped signal to an analog format suitable for transmission through a channel. Thereafter, the signal is provided to a line

driver/amplifier 416. The line driver/amplifier 416 manipulates the signal to a power level suitable for transmission over the channel. The degree or level of amplification may be dependant upon the power limits or specification as defined by a particular communication protocol, crosstalk and coupling concerns, and the distance to a 5 receiver or a repeater. The output of the line driver/amplifier 416 connects to a transformer/hybrid 420. The transformer/hybrid 420 provides isolation between transmit and receive signals as well as the channel itself. The output of the transformer/hybrid 420 connects to a channel.

Prior to discussion of further embodiments, additional discussion of far end 10 crosstalk (FEXT) is warranted. An aspect FEXT known as equal level FEXT (ELFEXT) is of importance to coupling cancellation. ELFEXT comprises the equivalent coupling at the far end of the channel measured with respect to an attenuated transmit signal. Removing FEXT is made difficult because FEXT is dependant on the length of the channel and since at least a portion of the FEXT signal 15 couples at the far end of the channel. As a result, the FEXT is also subject to ISI and attenuation as it passes through the reference channel. Considering FEXT as ELFEXT takes into consideration the effects of the channel, including the length of the line. Prior art solutions did not adequately address such aspects. Through consideration of this and other aspects a more complete coupling cancellation system and method may 20 be realized.

Figure 5 illustrates a block diagram of an example embodiment of a receiver having coupling cancellation components. This is but one possible receiver configuration that may adapt the principles described herein incorporate. It is

contemplated that other receiver configurations may be enabled without departing from the scope of the invention. As shown, the receiver 500 comprises an amplifier 504 configured to receive a signal arriving over a channel. The amplifier 504 increases the power level or voltage of the received signal, which may have been 5 attenuated by transmission through the channel. The amplified signal feeds into an analog to digital (A/D) converter 508, which in turn provides a digital signal, $rx(n)$, to a feed forward equalizer (FFE) 512. The output of the FFE, $x(n)$, connects to a summing junction 516. The term summing junction and subtractor are used interchangeably herein. The FFE 512 may be configured to reduce intersymbol 10 interference. It is contemplated that one of ordinary skill in the art is capable of FFE 512 construction and familiar with basic FFE operation. Accordingly, the basic principles of FFE operation are not discussed in detail herein beyond that associated with the new and distinctive features of the invention. It is further contemplated that filter or equalizer structures, other than an FFE 512, may be utilized without departing 15 from the scope of the invention.

The summing junction 516 also receives an input from a decision feedback equalizer (DFE) 524. The DFE 524 may be configured to reduce intersymbol interference. In one embodiment, the summing junction 516 subtracts the DFE output from the FFE output. The summing junction 516 provides its output, $s(n)$, to a 20 decision device, such as a slicer 520. The slicer 520 comprises any device capable of analyzing a received signal and quantizing the received signal to two or more distinct values. In one embodiment, the slicer 520 operates in conjunction with PAM10 mapping to quantize the input $s(n)$ to one of ten values. In one embodiment, the slicer

520 analyzes the received signal's voltage level, after processing, to determine the symbol sent over the channel. The output of the slicer 520 may comprise binary data or mapped voltage levels.

In this example embodiment, the slicer 520 provides its output to a de-
5 mapping and error correction module 528, the DFE 524 and a second summing junction 530. Demapping and error correction decoding are understood by those of ordinary skill in the art, and hence module 528 is not discussed in detail. The error correction processing, as part of the forward error correction, reduces the effective error rate of the data signal. Forward error correction may occur on binary data or
10 symbols.

It is contemplated that one of ordinary skill in the art is capable of DFE 524 construction and familiar with basic DFE operation. Accordingly, the basic principles of DFE operation are not discussed in detail herein beyond that associated with the new and distinctive features of the invention. It is further contemplated that other
15 filter or equalizer structures, other than an FFE 512 or DFE 524 may be utilized without departing from the scope of the invention. Although not shown, it is also contemplated that one or more delays may be utilized as necessary and as would be understood by one of ordinary skill in the art.

The FFE 512 and the DFE 524 perform equalization on the received signal to
20 compensate for the distorting effects of the channel. The DFE 524, as part of the feedback, receives and weights past values, which are subsequently subtracted, in the summing junction 516, from the arriving signal. It is contemplated that the FFE 512 and DFE 524 may possess coefficients, or other scaling values, associated with one or

more taps or stages of the FFE and the DFE. The coefficient values are selected to achieve desired signal equalization to thereby negate, reverse, or reduce the effects of the channel. In one embodiment the FFE 512 and DFE 524 coefficient value are selected based on the principles described herein. In one embodiment, the coefficient 5 values are arrived at using a least mean squared algorithm. In one embodiment, the coefficient values of the FFE 512, DFE 524, and the precode filter (element 408, Figure 4) are calculated and selected to counter the signal distorting effects of the channel while minimizing noise amplification and minimizing the undesirable effects of error propagation through the DFE feedback loop.

10 The output of the DFE 524 is also provided to a subtractor 530 where it is combined with the output of the slicer 520. The output of the subtractor 530 is provided to a FEXT filter 534. The FEXT filter 534 may comprise any type filter, including a digital filter, analog filter or combination thereof. It is also contemplated that the filtering may occur in software or hardware or both. In one embodiment, 15 FEXT filter 534 is trained to have a transfer function of \hat{A} , where \hat{A} comprises the transfer function that is or is similar to the ELFEXT coupled signal. Thus, the FEXT filter 534 is trained to have a transfer function that approximates the ELFEXT components that are coupled into the reference signal. The output of the FEXT filter 534 is provided to other transceivers in a multi-channel communication system so that 20 the ELFEXT components may be removed from the other channels in the multi-channel communication system. As more clearly illustrated in Figure 6, the FEXT filter 534 forms a feedback loop with the other transceivers. Application of the principles of the embodiment of Figure 5 is discussed below in more detail.

In operation, the system of Figure 5 operates, in conjunction with other transceivers, to receive and process a signal received over one of two or more channels. The use of subtractor 530 and FEXT filter 534 provide the advantage of isolating the ELFEXT component in the received signal.

5 As discussed above, one complex aspect of FEXT cancellation is that the equalization processes and the FEXT cancellation are often combined. Because of the complexity in equalization and FEXT cancellation, this process becomes undesirably complex and can require filters of unrealizable size, complexity, or of limited speed. As can be seen in Figure 5, the output of the slicer comprises a decision output that is
10 quantized to one of two or more predetermined values. Due to the feedback properties of the DFE 524, the DFE is optimized to account for the ISI aspects. The output of the DFE 524 is provided as an input to the subtractor 530. Thus, the output of the subtractor 530 may be considered to have had the unwanted ISI components removed from the slicer output. As a result, the construction of the FEXT filter 534
15 need only be concerned with reduction of remaining FEXT components. By separating the processing into two processing elements, i.e. elements 512, 524 and element 534, the complexity of each element is reduced as compared to systems of the prior art which realized the ISI reduction and FEXT cancellation in a single processing unit. Hence, the coefficients of FEXT filter 534 are selected to deal with
20 the FEXT components. As a result, the FEXT filter 534 may be made less complex than a filter attempting to perform both equalization and FEXT cancellation. For example, the length, i.e. the number of taps, of the required filters is reduced.

Stated another way, prior art systems that utilize a signal processing element, such as a filter, to remove both the ISI and the FEXT would in effect perform a convolution of the coefficients of the DFE 524 and the FEXT filter 534. However, as an advantage of the method and apparatus described herein, the cascode (**cascade?**) 5 configuration of these two filters eliminates the need for the convolution thereby eliminating a complex and computationally costly process.

Considering the embodiment shown in Figure 5, the DFE filter 524 is trained to have a transfer function of $1-B'(z)$ where $B(z)$ is the transfer function of the channel. The ELFEXT is defined at $A(z)$. As a result, The transfer function of the the 10 channel when considering FEXT coupling is $A(z)$ convolved with $B(z)$. If enabled in a single filter, an underably complex and undirably large filter would be required.

Based on the teaching contained herein, the processing may be simplified by configuring the FEXT filter 534 to have a transfer function of $\hat{A}(z)$ and be configured and trained to approximate the ELFEXT on the channel with which the FEXT filter 15 534 is associated. Thus, $\hat{A}(z)$ may be defined to be an estimate of the FEXT on the line. In general terms, the component B results from the line, i.e. the ISI component, while the \hat{A} component results from the FEXT. Through the **cascode** of the FEXT filter 534 and the DFE 524, the complexity of each filter is greatly reduced.

In one embodiment, the FEXT filter 534, in conjunction with the other 20 elements of the receiver, is defined as convolution of $B(z)$ with $\hat{A}(z)$. As a result, the signal $y(z)$ may be defined as $x(z)\hat{A}(z)B(z)$ which is the desired FEXT cancellation function. **[Inventors, this is from my notes, but it may need work. Please edit as appropriate** _____

5 .] Thus, in general terms, it is desired to adaptively train a FEXT canceller and provide the output signal of a FEXT canceller as an input at an appropriate place in the other receiver structures in a multi-channel communication device to cancel the FEXT components on the other channel. It is contemplated that this process operates in both directions in a bi-directional communication system to thereby provide positive feedback to each transceiver.

10 Figure 6 illustrates a block diagram of an example embodiment of the receiver shown in Figure 5 in a multi-channel configuration. As compared to Figure 5, similar elements are labeled with identical reference numerals. As shown, input signal 604A-604M, where M is any positive integer, are received over a multi-conductor communication system having M number of channels. The channels may comprise any medium capable of carrying a signal or data, such as but not limited, CAT5 15 cabling, wireless channels, fiber optic channels or cables, free-space optic channels, twisted pair conductors or any other conductive path, coaxial cables or other channels that are currently or that may become available in the future. Although shown with four channels, it is contemplated that the principles described herein may be expanded to any number of channels.

20 Operation of elements 512, 516, and 524 occur as described above in conjunction with Figure 5. Additional filters 534 are included as shown to account for the multi-channel configuration. Although not shown with connecting lines, the output of each filter 534 is routed as an input to a summing junction 610 of each

receiver to which FEXT coupling may occur. Accordingly, the output of each of the filters 534 is routed to an appropriate one of the summing junctions 610 to thereby cancel unwanted coupling. By way of example, the output of the filters 534AB generates an output A'B that is provided as an input to the summing junction 610B of the second channel, in this case channel B. In one embodiment, the receiver associated with channel A provides an FEXT cancellation signal to each of the other receivers in the multi-channel communication system. Hence, the filters 534AC, 534AD also generate outputs A'C and A'M respectively, which are provided to the summing junctions 610 of the channel C receiver and the channel Mth receiver as shown. This process occurs for each of the filters 534 as shown. The output of the filters 534 may comprise the FEXT cancellation signal. As a result, the subtractors 516 remove the FEXT components that were isolated by the other receivers. This occurs for each channel, as shown, and thus removes the FEXT components that coupled on to each channel from the other channels.

15 It is contemplated that one or more of the coefficients of the filters 534 may be set to zero or other nominally small value. If the computations that must be performed may not occur in a single cycle, then one or more of the initial coefficients may be set to zero or other nominally small value. [_____

20 _____ -
here. Please assist with this part or delete.]

As discussed, one advantage to the method and apparatus disclosed by Figures 5 and 6 is that each FEXT filter may be made less complex than in systems of the prior

art because the FEXT filter adapts to the transfer function of the FEXT on the channel instead of having to adapt for both the FEXT cancellation and equalization. As can be seen in Figure 6, each receiver includes a feedforward filter 512 and a feedback filter 524 to perform equalization. Thus, the existing equalization structure of each receiver 5 performs equalization, thereby requiring that the FEXT filter only adapt to the FEXT components for the channel to which the FEXT filter is feedback. Design and operation of a filter or other cancellation device configured to isolate only the FEXT components, as compared to the combined FEXT and equalization tasks is less complex. Consequently, distributing the processing burden between the filters as 10 shown improves performance and reduces complexity of both the FEXT cancellation systems and the equalizer systems.

Another advantage is that in one embodiment a unique filter is utilized for FEXT component isolation for each channel in a multi-channel communication system. For example, instead of a receiver having a complex filter to cancel all the 15 FEXT components that couple onto the channel, the method and apparatus disclosed herein utilizes a FEXT filter in each receiver to isolate a FEXT cancellation signal and distribute each FEXT cancellation signal to each of the other receivers. This further reduces the processing requirements and complexity of a multi-channel communication system.

20 It is contemplated that the filter coefficients, and in particular the coefficients of FEXT filter 534, may be established in any manner known in the art. Thus, the coefficients may be established during an initial training period or set at default value during manufacture. In one embodiment, the least mean square algorithm is utilized

to train or adapt the FEXT filters. It is further contemplated that the filter coefficients may be updated during system operation to thereby adapt to changing channel or environmental conditions. In one embodiment, training of the FEXT filter occurs while the filter is separate from the channel, such as when the channel is not 5 transmitting data and the effects of FEXT may be isolated.

Figure 7 illustrates a block diagram of an alternative embodiment of the FEXT cancellation and equalization system described herein. As compared to Figure 5, similar elements are identified with identical reference numerals. Accordingly, only aspects of Figure 7 that differ from Figure 5 are discussed in detail. As shown the 10 output of the FEXT filter 534 feeds into a delay element 704 and a subtractor 712. The subtractor 712 subtracts the output of the FEXT filter 534 from the output of the feedback filter 524 as shown and the resulting signal is provided to the subtractor 516. The subtractor 516 subtracts the resulting signal from the output of the feedforward filter as shown.

15 The output of the delay 704 connects to a summing junction 708 where it is combined with the output of the decision device 520. The summing junction 708 provide the combined signal to the feedback filter 524.

In operation, the system of Figure 7 generates the FEXT signal that is generated by the signals transmitted through the first channel 702A so that they may 20 be removed from the other channel(s) in the communication system. Thus, the output of the FEXT filter 534A comprises the FEXT components from the channel 702A that couple onto channel B 702B. This signal is provided to the feedback filter 524B so that the feedback filter may account for this aspect of the received signal when

equalizing the signal received over the second channel 702B. A delay 704A is utilized to account for delays that occur in the feedback filter or delays that may be necessary in the processing chain due to different rates of propagation of the signals through the multiple channels of the communication system. It is contemplated that 5 in other embodiments other amounts of delay may be introduced, or that delay may be introduced at locations other than that shown in Figure 7.

The output of the FEXT filter 534A that is provided to the subtractor 712B is eventually removed from the received signal, in this embodiment by subtractor 516B. In this manner, the FEXT components from one more channels may be subtracted 10 from the signals received on the other channels. The advantages discussed above with regard to figures 5 and 6 are also realized with this embodiment.

Also shown is the FEXT cancellation system 534B, 704A, and 712A for the first channel. This system is generally similar to the system described above and hence is not described again. Through use of this feedback system the coefficients in 15 filters 534 are selected to generate a FEXT cancellation signal that is feedback to the other receivers.

Although shown for purposes of discussion and understanding as a two channel, and hence a two receiver system, it is fully contemplated that the system and principles of Figure 7 may be applied to any number of receivers in a multi-channel 20 communication system to remove the FEXT coupled onto each channel. In a similar manner shown in Figure 6, the output of the filter may be provided to a structure as shown in Figure 7 to provide an inter-channel FEXT removal signal to each of the other receivers in a multi-receiver communication system.

It is understood that feedback based FEXT cancellation may best occur when the signals to be subtracted or removed from a received signal are present at one of the other receivers in a multi-receiver communication system. For example and in reference to Figure 6, to generate the cancellation signals provided to input 640 to 5 cancel the FEXT from the signal received on input 604B requires that the signals A'_B , C'_B , and M'_B have been received and processed by the filters 534AB, 534CB, 534MB respectively. Thus, there may be a feedback arrangement between receives of the multi-receiver communication device. As stated above, the term reference is used to designate which signal or channel of a multi-channel communication system is 10 undergoing FEXT cancellation. By way of example, when the signal of interest that is received over input 604B is undergoing FEXT cancellation, then this signal would be designated the reference signal and input 604B designated as the reference input or reference channel.

**[Will the principles of this invention apply to NEXT or ECHO
15 Cancellation also?]**

In some instances, the signals required to generate the FEXT cancellation signal do not arrive concurrent with or prior to the arrival of the FEXT signals that are coupled onto the reference signal. For example, the signals that are required to generate the FEXT cancellation signal are the signals that are transmitted on the 20 channels other than the reference channel. Hence, if all of the signals have not arrived, FEXT cancellation may not be possible. Such differences in arrival time may occur because FEXT coupling may propagate through the channel at a different rate than the signal of interest. In addition, some channels in a multi-channel

communication system are different lengths, thereby causing the signals to arrive at different times relative to a common transmit time.

As a result, some FEXT coupling may be present as a component of the reference signal even though the signal that generated the coupling has not yet arrived 5 at the reference receiver. This portion of the FEXT coupling may be referred to as the non-causal portion of the FEXT. In contrast, the causal portion of the FEXT may be defined as the FEXT components that arrive with or after the arrival of the signal that generated the FEXT. Failure to account for the different arrival rate of FEXT components, i.e. the non-causal FEXT components, may hinder operation of the 10 FEXT cancellation system. This is especially true as data communication rates increase since timing become more critical and each processing step must be completed within constrained time limits. The method and apparatus disclosed herein overcomes this challenge associated with FEXT cancellation by incorporating FEXT cancellations operations in the transmitter side of the communication system.

15 While it is contemplated that numerous filtering or FEXT cancellation systems may be incorporated into the transmitter, in one embodiment a FEXT precode filter is tailored to perform FEXT cancellation. The term precode filter as used herein is defined to mean a filter located in the transmitter. Use of a precode filter in a role unrelated to FEXT cancellation is shown in Figure 4. In general, one or more FEXT 20 precode filters may be located in one or more of the transmitters in a multi-channel communication system and may be trained to have a transfer function that will reduce or eliminate a portion of the FEXT coupling. Use of a precode filter allows the transmitter to remove a portion of the FEXT coupling prior to transmission and

thereby deal with the non-causal aspects of the FEXT, that is, the FEXT coupling that arrives on the reference channel after the arrival of that portion of the signal that generated the coupling.

In one embodiment, precoded FEXT cancellation comprises measuring the
5 FEXT response for a channel at the receiver and dividing by the impulse response of the line to obtain the FEXT precode filter coefficients. In another embodiment, the FEXT precode filter is trained using reference based training. In yet another embodiment, the filter coefficients are derived by training the filters associated with only one channel at a time.

10 In one embodiment, all or a portion of the FEXT cancellation is performed by a precode filter such that the FEXT precode filter isolates the FEXT transfer function for each of the other channels in a multi-channel communication system and provides its output to each of the other transmitters. The precode FEXT cancellation signal, which is generated by the FEXT precode filter, is combined with the signals being
15 transmitted on the other channels prior to transmission. This may occur for each transmitter in a multi-channel communication system. The coefficients for the FEXT precode filter may be established by processing that occurs in the transmitter or processing that occurs in the receiver.

Figure 8 illustrates a block diagram of an example embodiment of a
20 transmitter configured with a precode FEXT filter system. As compared to Figure 3, similar elements are identified with identical reference numerals. This example embodiment is configured as a three channel communication device, however, it is

contemplated that in other embodiments the principles may be extended to any communication system having two or more channels.

As shown in this embodiment, the output of the first precode filter 308 is directed not only to a summing junction 808, but also to one or more precode FEXT filters 812, 816. The precode FEXT filters 812, 816 process this input to generate a precoded FEXT cancellation signal that is fed back to summing junctions 808 in the other transmitters of a multi-channel communication system. For example, the precode FEXT filter 812A generates a precoded FEXT cancellation signal designated A'_B that is routed as an input to the summing junction 808B via input 820B. Likewise, the output of a precode FEXT filter 816A generates an output A'_C that is provided on input 820C to summing junction 808C. The precoded FEXT cancellation signals A'_B and A'_C may be subtracted from the signal that are to be transmitted over channel B and channel C. Subtracting the precoded FEXT cancellation signals A'_B and A'_C cancels the FEXT that will be generated by the signal traveling over channel A and that will couple onto channel B and channel C. This configuration repeats with the other transmitters associated with the one or more other channels. Hence, input 820A provides precode FEXT cancellation signals that are generated by the other transmitters to the channel A transmitter.

In one embodiment, the precode FEXT filters located in the two or more transmitters operate in conjunction with the FEXT filters described above that are located in the receivers. In such an embodiment, a portion of the FEXT cancellation may occur in the transmitter and a portion may occur in the receiver. In one configuration, one or more of the FEXT filter coefficients of the receiver FEXT filter

are set to zero or other nominal value. It is contemplated that these coefficients comprise the coefficients that account for the non-causal portion of the FEXT coupling as seen by the receivers. Hence, the precode FEXT filter may be considered a non-causal filter.

5 Stated another way, to account for the FEXT coupling on the reference signal that arrives prior to the arrival, at the other receivers of the signals that generated the FEXT coupling, certain aspects of FEXT cancellation are transferred to the precode FEXT filter. In one embodiment, the aspects of FEXT cancellation that are transferred to the precode FEXT filter comprise those aspects that cancel non-causal 10 FEXT. This occurs, because, non-causal FEXT is considered to arrive on the reference signal prior to the arrival, at other receivers in the multi-channel communication system, of the signals that generate the FEXT coupling. Hence, the duties performed by one or more coefficients of the receiver FEXT filter may be transferred to the precode FEXT filter. As a result, certain coefficients of the FEXT 15 filters located in the receiver may be set to zero. In one embodiment an identical number of coefficients values are transferred from the receiver FEXT filter to the precode FEXT filter. Although any number of coefficients values may be set to zero, in one embodiment _____ receiver filter coefficients are set to zero. The number of coefficients may range from zero to _____.

20 The precode FEXT filters 812, 816 may comprise any type of filter capable of manipulating an input signal to generate a FEXT cancellation signal. In one embodiment the precode FEXT filter 812, 816 comprises an adaptive digital filter, such as but not limited to a finite impulse response filter _____

_____. The precode FEXT filters 812, 816 may comprises either a transposed or transversal configuration, or any other configuration. The filters 812, 816 may be of any size. In one embodiment, the filters range form ____ to ____ tops.

5 In an alternative embodiment, shown in Figure 9, the precode FEXT filters are located before the standard precode filter 308 as shown. This configuration achieves the advantage of _____.
_____. It is contemplated that one of ordinary skill in the art may arrive at other configurations
10 that do not depart from scope of the claims that follow.

Figure 10A and 10B illustrate an operational flow diagram of an example method of operation of one embodiment of the invention. The method of operation shown in Figure 10A and 10B encompasses operation of a system having the precode FEXT cancellation and receiver FEXT cancellation capability. It is contemplated however, that other embodiments may implement only one of these types of FEXT cancellation without departing from the scope of the invention. In reference to Figure 10A, at a step 1004, a reference transmitter at a first station receives a reference signal from a signal source. It is contemplated that the reference transmitter comprises a transmitter, which is the focus of this discussion, and the term reference is utilized to distinguish it from the other transmitters in a multi-transmitter communication system. The reference signal is utilized to generate FEXT cancellation signals, which are subtracted from the signal processed by the other transmitters.

Next or concurrently, at a step 1106, the other transmitters in the multi-transmitter communication system receive signals that are to be transmitted to a second station. Thus, multiple signals may be simultaneously transmitted over two or more channels. Thereafter, at a step 1008, the reference transmitter directs the 5 reference signal to one or more precode FEXT filters to generate FEXT cancellation signals. The operation and configuration of the precode FEXT filters is discussed above and thus is not discussed again. It is contemplated that the number of precode FEXT filters may correspond to the number of channels. Thus, a four channel communication system would comprise four transmitters and four receivers at each 10 station. In such an embodiment, the reference signal would be provided to each of three precode FEXT filters.

Thereafter, at a step 1012, the precode FEXT filter processes the reference signal to generate FEXT cancellation signals. In one embodiment, a unique FEXT cancellation signal is generated for each of the other channels while in another 15 embodiment a single signal is generated for use by each channel. In one embodiment, processing by the precode FEXT filter comprises generating a signal that has a transfer function generally equivalent to the non-causal portion of the FEXT which will couple onto the other channels to which the particular precode FEXT filter output will be provided. [_____]

20 _____ . Correct ??] Operation of a digital filter is generally understood _____ by one of ordinary skill in the art and hence is not discussed in detail here.

At a step 1016, the outputs, that comprises FEXT cancellation signals, of each precode FEXT filter of the reference transmitter are routed to the appropriate transmitter in the multi-channel communication system. As shown, in Figure 6 the transmitter associated with channel A includes a precode FEXT filter configured to 5 generate a FEXT cancellation signal directed to each of the other transmitters. Each FEXT cancellation signal is tailored to cancel the non-causal portion of the FEXT signal that will couple onto the respective channel to which the cancellation signal is provided.

At a step 1020, the FEXT cancellation signals that are routed to each 10 respective transmitter are subtracted from the signal processed by the respective transmitter. As result of subtracting the FEXT cancellation signal from each of the signals on the other channels in the transmitter, the non-causal FEXT coupling is canceled prior to transmission. This provides the advantage of canceling the FEXT coupling that the FEXT filters located in the receiver would be unable to remove.

15 Next, at step 1024, this process is repeated in the reference transmitter. Hence, the reference transmitter receives one or more cancellation signals from the other transmitters in the multi-transmitter communication system. At a step 1028, these FEXT cancellation signals are subtracted from the reference signal. As a result, a portion of the FEXT that would otherwise couple onto the reference signal as it 20 passes through the channel is canceled in advance of its coupling, i.e. prior to transmission of the reference signal. Thereafter, at a step 1032, the two or more transmitters transmit the reference signal and the other signals via the multiple channels to the receivers at a second station .

At a step 1036, the reference signal and the other signals are received at the receivers of the second station. The precode filter FEXT cancellation may only cancel a portion of the FEXT that couples onto the signals as they pass through the channel. Consequently, additional FEXT cancellation may improved signal decoding.

5 Accordingly, at a step 1036, the cancellation process of this embodiment processes the received reference signal to generate a processed reference signal. The processing may comprise any type of processing that occurs in a receiver. In one embodiment, the processing comprises processing to reduce or eliminate intersymbol interference.

[Is there a broad term for this type of processing. This seems important since in

10 general, a first type processing is combined with FEXT filtering to reduce FEXT filter complexity.] In other embodiments, _____ type processing may occur. As an advantage to the method of operation of this embodiment, the _____ processing reduces the computational burden of the FEXT filtering. It is contemplated that the processing of step 1036 may occur prior to or after FEXT

15 filtering.

Turning now to Figure 10B, at a step 1040 the processed reference signal is provided to one or more FEXT filters that are located in the reference receiver. As shown in Figure 6, a FEXT filter may exist and be configured to generate a FEXT cancellation signal tailored to cancel the FEXT from the reference signal that coupled onto the signals arriving on each of the other receivers. At a step 1044, the one or more FEXT filters manipulate the processed reference signal to generate one or more FEXT cancellation signals. In one embodiment, each FEXT filter generates a FEXT cancellation signal that is routed to one of the other receivers. At a step 1048, the

FEXT cancellation signals, generated from FEXT filtering the reference signal, are distributed to each of the other receivers in the second station. Thereafter, at a step 1052, the system subtracts the FEXT cancellation signal from the signal being processed by each respective receiver to thereby cancel the remaining FEXT that has 5 coupled onto the line and which was not already cancelled by the precode FEXT. In one embodiment, canceling the remaining FEXT comprises canceling the causal portion of the FEXT coupling.

At a step 1056, this processes is repeated for the reference receiver. Thus, one or more FEXT cancellation signals from the other receives in the second station are 10 routed to the reference receiver and, at a step 1060, these signals are subtracted from the reference signal. In one embodiment, the subtraction of the cancellation signals occurs prior to the processing described in step 1036. In other embodiment, the subtraction may occur after processing. At a step 1064, the reference signal and the other received signals may be output from the receivers of the second station for 15 subsequent processing. It is contemplated that this method of operation may occur continuously to cancel FEXT coupling during data transmission between the first station and the second station.

While various embodiments of the invention have been described, it will be apparent to those of ordinary skill in the art that many more embodiments and 20 implementations are possible that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A multi-channel communication system having a first station and a second station configured to communicate over two or more channels comprising:
 - 5 a first station having two or more transmitters configured to send two or more transmitted signals over two or more channels from the first station to the second station;
 - 10 a second station having two or more receivers configured process a received signal, wherein each received signal comprises the transmitted signal and a coupling signal and wherein at least one receiver comprises:
 - 15 a decision device configured to generate a decision output based on at least the receive signal and a modified decision output;
 - 20 a feedback system configured to generate a modify decision output and combine the modified decision output, the received signal, and one or more incoming cancellation signals;
 - 25 a subtractor configured to subtract the modified decision output from decision output to create a third signal; and
 - 30 a processing system configured to process the third signal to create one or more outgoing cancellation signals.
2. The system of Claim 1, wherein the communication system is further configured to transmit data from the second station to the first station.
- 25 3. The system of Claim 1, wherein the one or more incoming cancellation signals comprise one or more cancellation signals configured to remove FEXT coupling from the received signal.

4. The system of Claim 1, wherein the subtractor is further configured to subtract the modified decision output and one or more incoming cancellation signals from decision output to create the third signal.

5 5. The system of Claim 1, wherein the processing system comprises two or more FEXT filters.

6. The system of Claim 1, wherein each receiver generates a unique cancellation signal tailored for each of the other receivers.

10

7. The system of Claim 1, wherein the feedback system comprises a decision feedback filter.

15

9. The system of Claim 1, wherein the multi-channel communication system comprises a four channel communication system configured to operate in accordance with an Ethernet Communication Standard.

20

10. The system of Claim 1, wherein the two or more transmitters of the first station further comprises two or more FEXT precode filters configured to modify the two or more signals prior to transmission to cancel FEXT coupling.

25

11. The system of Claim 10, wherein each transmitter includes one or more FEXT precode filters configured to generate and provide one or more precode cancellation signals to other transmitters.

30

12. A multi-channel communication system configured to reduce noise comprising:

one or more transmitters configured to transmit a first signal on a first channel and a second signal on a second channel; and

5 a first receiver configured to receive a third signal on the first channel and a second receiver configured to receive a fourth signal on the second channel, wherein the third signal comprises the first signal and a first noise component and the fourth signal comprises the second signal and a second noise component wherein;

the first receiver further comprising:

10 a first feedback filter loop configured to receive the third signal and reduce noise on the third signal, the output of the first feedback filter loop comprising a first feedback filter loop output;

a first device configured to receive a second cancellation signal from the second receiver and combine the second cancellation signal with the first feedback filter loop output to create a first device output;

15 a first filter configured to receive the third signal and the first device output and generate a first cancellation signal; and

the second receiver further comprising:

20 a second feedback filter loop configured to receive the fourth signal and reduce noise on the fourth signal, the output of the second feedback filter loop comprising a second feedback filter loop output;

a second device configured to receive the first cancellation signal from the first receiver and combine the first cancellation signal with the second feedback filter loop output to create a second device output;

25 a second filter configured to receive the fourth signal and the second device output and generate the second cancellation signal.

13. The system of Claim 12, wherein the first device and the second comprise a summing junction.

14. The system of Claim 12, wherein the first and second feedback filter loops comprise a decision device and a decision feedback filter configured to reduce intersymbol interference.

5 15. The system of Claim 12, wherein the multi-channel communication system has four channels.

10 16. The system of Claim 12, wherein the first filter configured to receiver third signal and the second filter configured to receive the fourth signal comprise digital filters having coefficient values selected to generate cancellation signals that cancel FEXT coupling.

17. The system of Claim 12, wherein the one or more transmitters further comprise precode filters.

15 18. The system of Claim 12, wherein at least one of the one or more transmitters is configured to generate an outgoing precode cancellation signal and receive an incoming precode cancellation signal from another transmitter.

20 19. A receiver for use in a multi-channel communication system to cancel FEXT that has coupled onto a transmitted signal and reduce intersymbol interference that is distorting the transmitted signal, a distorted version of the transmitted signal and FEXT coupling comprising a combined signal, the receiver comprising:

25 a first device configured to receive and subtract a feedback signal and one or more received cancellation signals, received from other receivers, from the combined signal to create a decision device input signal;

a decision device configured to process the decision device input signal to generate a discrete output;

30 a decision feedback equalizer configured to receive and process the discrete output to generate an equalizer output;

a second device configured to combine the equalizer output and the one or more received cancellation signals to create the feedback signal;

a third device configured to subtract the feedback signal from the discrete output; and

5 one or more FEXT filters, each configured to generate a cancellation signal tailored to cancel FEXT coupling on another channel in the multi-channel communication device.

20. The receiver of Claim 19, wherein the first, second, and third devices
10 comprise subtractors.

21. The receiver of Claim 19, wherein the decision device comprises a ten output level slicer.

15 22. The receiver of Claim 19, wherein a station in the communication system comprises four receivers.

20 23. The receiver of Claim 19, further comprising a first filter configured to process the combined signal to reduce intersymbol interference on the combined signal.

24. A receiver in a multi-receiver system configured to receive two or more signals via two or more channels, each respective receiver comprising:

an input configured to accept a received signal;

25 a decision device configured to quantize a decision device input signal to one of two or more decisions values, the decision device input signal based on the received signal;

a first filter configured to process the decision values to create a first filtered signal;

one or more FEXT filters configured to processes the decision values and the first filtered signal to create a cancellation signal tailored to cancel coupling on one or more other channels;

one or more devices configured to:

5 receive one or more cancellation signals from other receivers in the multi-receiver system; and

process the cancellation signals and the received signal received to cancel unwanted coupling in the received signal.

10 25. The receiver of Claim 24, wherein the first filter comprises a digital filter configured to reduce intersymbol interference.

15 26. The receiver of Claim 24, wherein the decision device quantizes the decision device input signal to any one of ten values based on a comparison to predetermined thresholds.

20 27. The receiver of Claim 24, wherein the one or more FEXT filters comprise digital filters having two or more coefficients and the one or more FEXT filters and the first filter are configured to cancel coupling and reduce intersymbol interference.

28. The receiver of Claim 24, further comprising a second filter configured to process the received signal to reduce intersymbol interference.

25 29. The receiver of Claim 24, wherein the one or more devices comprise one or more summing junctions.

30. A method for reducing noise in a multi-channel communication system having two or more receivers and two or more channels comprising:

receiving a first signal on a first channel with a first receiver and a second signal on a second channel with a second receiver;

combining a feedback signal with the first received signal to create a first combined signal;

5 processing the first combined signal to reduce interference in the first combined signal to create a processed signal, the interference created by passage of the first signal through the first channel;

combining the processed signal with at least a first cancellation signal received from at least the second receiver to create a feedback signal;

10 combining the feedback signal with the processed signal to create a second combined signal;

processing the second combined signal to generate at least a second cancellation signal.

15 31. The method of Claim 30, wherein the combining a feedback signal with the first received signal cancels FEXT coupling in the first received signal.

20 32. The method of Claim 30, wherein processing the first combined signal comprises performing decision feedback equalization on the signal to reduce intersymbol interference.

33. The method of Claim 30, further comprising quantizing the first combined signal with a decision device to create the first combined signal.

25 34. The method of Claim 30, wherein the second receiver is configured similarly to the first receiver and the second receiver generates the first cancellation signal and receives the second cancellation signal from the first receiver.

30 35. The method of Claim 30, further including delaying the first cancellation signal to achieve proper timing.

36. A receiver for FEXT cancellation in a multi-channel communication system comprising:

5 a feedback loop comprising:

a first device configured to combine a received signal with a feedback signal and an one or more incoming cancellation signals to create a combined signal;

a decision device configured to process the combined signal to generate a decision output;

10 a first filter configured to generate a feedback signal based on the decision output and the one or more incoming cancellation signals or a delayed version of the one or more incoming cancellation signals, wherein the one or more incoming cancellation signals are received from one or more other transmitters in the multi-channel communication system; and

15 one or more FEXT filters configured to receive the decision output and generate one or more outgoing FEXT cancellation signals which are routed to other receivers in the multi-channel communication system.

20 37. The receiver of Claim 36, wherein the first device comprises a subtractor or summing junction.

38. The receiver of Claim 36, wherein the decision output comprises a signal that has undergone the FEXT cancellation.

25 39. The receiver of Claim 37, further comprising a feedforward filter configured to process the received signal prior to the received signal arriving at the feedback loop.

40. The receiver of Claim 37, wherein a receiver is associated with each channel in the multi-channel communication system and each receiver receives an incoming cancellation signal from each of the other receivers.

5 41. A method for noise reduction in a multi-channel communication system having two or more receivers comprising:

receiving a signal over a channel;
receiving one or more cancellation signals from other receivers in the multi-channel communication system;

10 processing the received signal and the one or more cancellation signals from the other receivers to generate a feedback signal; and

combining the feedback signal with the received signal to cancel coupling in the received signal.

15 42. The method of Claim 41, further comprising generating one or more outgoing cancellation signals and providing the one or more outgoing cancellation signals to other receivers in the multi-channel communication system.

20 43. The method of Claim 41, further comprising combining the feedback signal with the one or more cancellation signals from the other receivers prior to combining the feedback signal with the received signal to reduce noise in the received signal.

25 44. The method of Claim 41, wherein processing comprises processing with a decision feedback equalizer.

45. The method of Claim 44, wherein processing further comprises quantizing the combination of the received signal and the one or more cancellation signals to one of one or more discrete levels prior to processing.

46. A system for canceling one or more FEXT signals that have coupled onto a transmitted signal to create a modified signal in a multi-channel communication device comprising:

means for receiving the modified signal over a channel in the multi-channel communication system;

means for combining the modified signal with a feedback signal isolate the transmitted signal;

means for generating the feedback signal comprising:

means for filtering the isolated transmitted signal to create a filtered signal;

means for receiving and combining and the filtered signal and one more cancellation signals from other receivers in the multi-channel communication device;

means for generating one or more cancellation signals to be outputted to one or more other receivers.

47. The system of Claim 46, wherein means for generating further comprises a decision device.

48. The system of Claim 46, wherein the means for generating one or more cancellation signals comprises:

means for combining the transmitted signal and the feedback signal to create a cancellation filter input signal, and

means for processing the cancellation filter input signal to create FEXT cancellation signals to be provided to other receivers.

ABSTRACT

A method and apparatus for noise reduction in a multi-channel communication system is disclosed. In one embodiment one or more FEXT filters in each receiver of each station of a communication system generate one or more cancellation signals. Each FEXT filter may have a unique transfer function that is the inverse of the ELFEXT coupling of the channel with which the FEXT filter is associated. The one or more cancellation signals are routed to other receivers in the station and combined with each receiver's respective incoming signal to cancel FEXT coupling. In one embodiment one or more precode FEXT filters are utilized in each transmitter of a station to generate one or more precoder cancellation signals. The precoder cancellation signals are routed to other transmitters within the station and combined with outgoing signals to cancel the effects of FEXT coupling prior to transmission of the outgoing signals.

**WEIDE &
MILLER, Ltd.**

11th Floor, Suite 1130, Phoenix Building
330 South 3rd Street
Las Vegas, NV 89101
Telephone (702)-382-4804
Facsimile (702)-382-4805

E-mail: CMiller@WeideMiller.com
On the web: www.WeideMiller.com

CHAD W. MILLER
REGISTERED PATENT ATTORNEY
LICENSED IN CALIFORNIA & NEVADA

October 7, 2002

VIA PRIORITY MAIL

Mr. Ben Charny
Executive Vice President and CFO
SolarFlare Communications, Inc.
9501 Jeronimo Rd., Suite 100
Irvine, CA 92618

RE: October 2002 Invoice

Dear Ben:

Enclosed is our invoice for October 2002. Please contact me if you have any questions.

Best Regards,


Chad W. Miller

Enclosure

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: October 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**
To: **Subject Matter: General Intellectual Property Representation**

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
9/5/02	CWM	Update status report	0.10 220.00/hr	22.00
9/11/02	CWM	Draft e-mail to G. Zimmerman providing updated status report; update status report	0.10 220.00/hr	22.00
9/25/02	CWM	Conference with B. Jones regarding status of patent matters	0.20 220.00/hr	44.00
For professional services rendered			0.40	\$88.00
Balance due				\$88.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Channel Equalization
 Serial No.: 10/188,274

	<u>Amount</u>
Previous balance	\$104.00
10/4/02 Payment - thank you	(\$104.00)
Total payments and adjustments	(\$104.00)
 Balance due	 \$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**
To: **Subject Matter: Patent Prosecution**
 Title: Communication System
 Serial No.: 10/194,775

	<u>Amount</u>
Previous balance	\$36.00
10/4/02 Payment - thank you	(\$36.00)
Total payments and adjustments	(\$36.00)
 Balance due	 \$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**
To: **Subject Matter: Patent Prosecution**
 Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation
 Serial No.: Not yet assigned

	<u>Amount</u>
Previous balance	\$3,696.00
10/4/02 Payment - thank you	(\$3,696.00)
Total payments and adjustments	(\$3,696.00)
 Balance due	 \$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**
To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Constellation Shaping
Serial No.: 10/194,741

	<u>Amount</u>
Previous balance	\$104.00
10/4/02 Payment - thank you	(\$104.00)
Total payments and adjustments	(\$104.00)
 Balance due	 \$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**
 To: **Subject Matter: Patent Prosecution**
 Title: Multiple Channel Interference Cancellation
 Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>		
9/5/02	CWM	Draft text associated with method of operation figures and update figures	3.30 220.00/hr	726.00		
9/6/02	CWM	Draft claims and draft portion of application relation to method of operation	5.70 220.00/hr	1,254.00		
9/9/02	CWM	Draft claims and send application to W. Jones via e-mail	4.80 220.00/hr	1,056.00		
9/17/02	CWM	Conference with B. Jones regarding patent application	0.70 220.00/hr	154.00		
For professional services rendered			14.50	<u>\$3,190.00</u>		
Previous balance				\$396.00		
10/4/02	Payment - thank you			<u>(\$396.00)</u>		
Total payments and adjustments				<u>(\$396.00)</u>		
Balance due				<u><u>\$3,190.00</u></u>		

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0007P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Bandwidth Enhancement of Transformers
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
9/12/02	CWM	Draft specification and modify figures of patent application; draft description of figures	4.60 220.00/hr	1,012.00
9/13/02	CWM	Draft specification of patent application	5.70 220.00/hr	1,254.00
9/15/02	CWM	Draft portion of application concerning Figures 7A and 7B; update Description of Figures	0.90 220.00/hr	198.00
9/16/02	CWM	Draft patent application claims and abstract	5.70 220.00/hr	1,254.00
9/17/02	CWM	Revise portion of patent application; short conference call with inventor to verify terminology	1.30 220.00/hr	286.00
9/25/02	CWM	Conference with inventors regarding status and to discuss one aspect of invention	0.30 220.00/hr	66.00
For professional services rendered			18.50	\$4,070.00
Balance due				\$4,070.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0008P**
 To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Cancellation Using Mixed Signal Processing
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
9/2/02	CWM	Draft patent application and create figures	4.30 220.00/hr	946.00
9/3/02	CWM	Review and revise application; draft figures relating to method of operation	2.80 220.00/hr	616.00
9/4/02	CWM	Continue draft patent application and create figures	3.40 220.00/hr	748.00
9/7/02	CWM	Draft claims and draft portion of application relation to method of operation of mixed signal cancellation	4.30 220.00/hr	946.00
9/9/02	CWM	Revise portion of application dealing with mixed signal cancellation	0.80 220.00/hr	176.00
For professional services rendered			15.60	<u><u>\$3,432.00</u></u>
Balance due			<u><u>\$3,432.00</u></u>	

In Reference **Weide & Miller Ref. No.: SLRFLR.0010P**
To: **Subject Matter: Patent Prosecution**
 Title: PCS for 'Reshape' Communication Device
 Serial No.: Not yet assigned

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
9/18/02	Schedule disclosure meeting with B. McClellan; review e-mail with attachments	0.50 220.00/hr	110.00
9/25/02	Conference with B. McClellan to obtain invention disclosure; prepare for same by reviewing disclosure documents and portion of specification	5.30 220.00/hr	1,166.00
For professional services rendered		5.80	\$1,276.00

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: October 06, 2002

Invoice submitted to: **SolarFlare Communications, Inc.**
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**
To: **Subject Matter: General Intellectual Property Representation**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$88.00	\$0.00	\$88.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**
To: **Subject Matter: Patent Prosecution**
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**
To: **Subject Matter: Patent Prosecution**
Title: Communication System
Serial No.: 10/194,775

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0004P
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0005P
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Constellation Shaping
Serial No.: 10/194,741

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0006P
Subject Matter: Patent Prosecution
Title: Multiple Channel Interference Cancellation
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$3,190.00	\$0.00	\$3,190.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0007P
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Bandwidth Enhancement of Transformers
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$4,070.00	\$0.00	\$4,070.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0008P

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Cancellation Using Mixed Signal Processing

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$3,432.00	\$0.00	\$3,432.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0009P

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Noise Cancellation Based on Transmitter Processing

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference
To:

Weide & Miller Ref. No.: SLRFLR.0010P

Subject Matter: Patent Prosecution

Title: PCS for 'Reshape' Communication Device

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$1,276.00	\$0.00	\$1,276.00

Summary For All Matters:

\$12,056.00	\$0.00	\$12,056.00
-------------	--------	-------------

GRAND TOTAL OF ALL AMOUNTS
DUE:

\$12,056.00

WEIDE &
MILLER, Ltd.

11th Floor, Suite 1130, Phoenix Building
330 South 3rd Street
Las Vegas, NV 89101
Telephone (702)-382-4804
Facsimile (702)-382-4805

E-mail: CMiller@WeideMiller.com
On the web: www.WeideMiller.com

CHAD W. MILLER
REGISTERED PATENT ATTORNEY
LICENSED IN CALIFORNIA & NEVADA

November 5, 2002
VIA PRIORITY MAIL

Mr. Ben Charny
Executive Vice President and CFO
SolarFlare Communications, Inc.
9501 Jeronimo Rd., Suite 100
Irvine, CA 92618

RE: November 2002 Invoice

Dear Ben:

Enclosed is our invoice for November 2002. Please contact me if you have any questions.

Best Regards,


Chad W. Miller

Enclosure

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: November 05, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0001G**
Subject Matter: General Intellectual Property Representation

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
10/1/02	CWM Update and send status report	0.10 220.00/hr	22.00
For professional services rendered		0.10	\$22.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0002P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy	0.20 220.00/hr	44.00
10/29/02	CWM	Draft letter enclosing Corrected Filing Receipt and review same for accuracy	0.20 220.00/hr	44.00
For professional services rendered			0.40	\$88.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0003P**
Subject Matter: Patent Prosecution
Title: Communication System
Serial No.: 10/194,775

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy	0.20 220.00/hr	44.00
10/25/02	CWM	Prepare Information Disclosure Statement and file same with Patent Office	0.90 220.00/hr	198.00
10/28/02	CWM	Draft and send letter to W. Jones enclosing Information Disclosure Statement that was filed with Patent Office	0.10 220.00/hr	22.00
For professional services rendered			1.20	\$264.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0005P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Constellation Shaping
Serial No.: 10/194,741

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	0.20 220.00/hr	44.00
			<hr/>
For professional services rendered			0.20
			<hr/>
			\$44.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0007P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Bandwidth Enhancement of Transformers

Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
10/2/02	CWM	Review and revise patent application	4.80 220.00/hr	1,056.00
10/13/02	CWM	Review and revise figures; supplement application	3.90 220.00/hr	858.00
10/15/02	CWM	Draft letter sending application to inventors	0.10 220.00/hr	22.00
For professional services rendered			8.80	\$1,936.00

(In Reference To: **Weide & Miller Ref. No.: SLRFLR.0010P**
Subject Matter: Patent Prosecution
Title: Transmit Reshaper
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	Outline specification and outline figures	4.30 220.00/hr	946.00
10/4/02	CWM	Draft background section and outline figures	1.20 220.00/hr	264.00
10/8/02	CWM	Draft background section; create figures	3.30 220.00/hr	726.00
10/9/02	CWM	Review disclosure notes; create figures; outline application	2.60 220.00/hr	572.00
10/14/02	CWM	Draft figures and patent application; review disclosure tape	3.60 220.00/hr	792.00
10/15/02	CWM	Draft patent application	5.40 220.00/hr	1,188.00
10/18/02	CWM	Draft patent application	2.80 220.00/hr	616.00
10/20/02	CWM	Review e-mail with attachments from B. McCellan; select figure from attachments for use in application; draft application	1.60 220.00/hr	352.00
10/24/02	CWM	Draft portion of patent application dealing with receiver	1.10 220.00/hr	242.00
For professional services rendered			25.90	\$5,698.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0011G**
Subject Matter: Patent Prosecution
Title: Receive Reshaper
Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
10/21/02	CWM	Draft patent application	1.80 220.00/hr	396.00
10/28/02	CWM	Draft patent application	0.40 220.00/hr	88.00
10/29/02	CWM	Draft portion of application dealing with receive reshaper	2.30 220.00/hr	506.00
10/30/02	CWM	Create new figures; draft portion of application dealing with new figures and review last part of disclosure tape	2.80 220.00/hr	616.00
10/31/02	CWM	Draft patent application	1.40 220.00/hr	308.00
			<hr/>	<hr/>
For professional services rendered			8.70	\$1,914.00

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: November 05, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference To: Weide & Miller Ref. No.: SLRFLR.0001G
Subject Matter: General Intellectual Property Representation

New Fees	New Costs	Total New Charges
\$22.00	\$0.00	\$22.00

In Reference To: Weide & Miller Ref. No.: SLRFLR.0002P
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

New Fees	New Costs	Total New Charges
\$88.00	\$0.00	\$88.00

In Reference To: Weide & Miller Ref. No.: SLRFLR.0003P
Subject Matter: Patent Prosecution
Title: Communication System
Serial No.: 10/194,775

New Fees	New Costs	Total New Charges
\$264.00	\$0.00	\$264.00

(In Reference To: **Weide & Miller Ref. No.: SLRFLR.0005P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Constellation Shaping
Serial No.: 10/194,741

New Fees	New Costs	Total New Charges
\$44.00	\$0.00	\$44.00

(In Reference To: **Weide & Miller Ref. No.: SLRFLR.0006P**
Subject Matter: Patent Prosecution
Title: Multiple Channel Interference Cancellation
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

(In Reference To: **Weide & Miller Ref. No.: SLRFLR.0007P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Bandwidth Enhancement of Transformers
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$1,936.00	\$0.00	\$1,936.00

(In Reference To: **Weide & Miller Ref. No.: SLRFLR.0008P**
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Cancellation Using Mixed Signal Processing
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0010P**
Subject Matter: Patent Prosecution
Title: Transmit Reshaper
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$5,698.00	\$0.00	\$5,698.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0011G**
Subject Matter: Patent Prosecution
Title: Receive Reshaper
Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$1,914.00	\$0.00	\$1,914.00

Summary For All Matters: \$9,966.00

GRAND TOTAL OF ALL AMOUNTS
DUE: \$9,966.00

Chad Miller

From: Chad W. Miller [CMiller@WeideMiller.com]
Sent: Monday, September 09, 2002 8:42 AM
To: William Jones Ph. D.; George Zimmerman
Subject: Electronic Copy of SLRFLR.0004P (Equalization and FEXT Mitigation)
Attachments: CWM-W-0066.doc; SLRFLR.0004P.vsd; SLRFLR.0004L.vsd

Attached is an electronic copy of the above-referenced application with Figures.

Please let me know if you have any questions. I look forward to your feedback and any changes you may have.

Best Regards,

Chad W. Miller

Weide & Miller, Ltd
CMiller@WeideMiller.com
702-382-4804

This communication is for its intended recipient only, and may contain information that is privileged, confidential and exempt from disclosure under applicable law. If you are not the intended recipient or the employee or agent responsible for delivering this communication to the intended recipient, you are hereby notified that any unauthorized use, dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone (702-382-4804) or e-mail reply, delete it from your system, and destroy any hard copy you may have printed. Thank you.

**WEIDE &
MILLER, Ltd.**

11th Floor, Suite 1130, Phoenix Building
330 South 3rd Street
Las Vegas, NV 89101
Telephone (702)-382-4804
Facsimile (702)-382-4805

E-mail: CMiller@WeideMiller.com
On the web: www.WeideMiller.com

CHAD W. MILLER
REGISTERED PATENT ATTORNEY
LICENSED IN CALIFORNIA & NEVADA

December 4, 2002

VIA PRIORITY MAIL

Mr. Ben Charny
Executive Vice President and CFO
SolarFlare Communications, Inc.
9501 Jeronimo Rd., Suite 100
Irvine, CA 92618

RE: December 2002 Invoice

Dear Ben:

Enclosed is our invoice for services provided in November. Please contact me if you have any questions.

Best Regards,



Chad W. Miller

Enclosure

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: December 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference To: Weide & Miller Ref. No.: SLRFLR.0001G
Subject Matter: General Intellectual Property Representation

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
11/1/02	CWM	Update and send status report	0.10 220.00/hr	22.00
11/4/02	CWM	Draft e-mail to G. Zimmerman and W. Jones regarding foreign rights	0.20 220.00/hr	44.00
	CWM	Draft e-mail to G. Zimmerman and B. Charney providing billing estimate; obtain billing estimate	0.10 220.00/hr	NO CHARGE
11/5/02	CWM	Conference with W. Jones regarding potential disclosure Standards Meeting; receive revised application; receive e-mail authorizing filing of provisional application; research related case and suggest filing of two applications in e-mailed response; initiate filing of provisional	0.70 220.00/hr	154.00
11/27/02	CWM	Conference with W. Jones to schedule meeting	0.10 220.00/hr	22.00
For professional services rendered			1.20	\$242.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0004P****Subject Matter:** Patent Prosecution**Title:** Method and Apparatus for Joint Equalization and Crosstalk Mitigation**Serial No.:** Not yet assigned**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
11/7/02	CWM	Revise specification to place application in form for provisional filing; combine both applications to single provisional specification with combined claims and figures; prepare transmittal and file provisional application	2.10 220.00/hr	462.00
11/12/02	CWM	Draft letter enclosing filed provisional patent application	0.10 220.00/hr	22.00
11/20/02	CWM	Draft letter regarding receipt of postcard for provisional patent application filing	0.10 220.00/hr	22.00
11/27/02	CWM	Conference with W. Jones regarding changes to patent application	0.30 220.00/hr	66.00
For professional services rendered			<hr/>	<hr/>
For professional services rendered			2.60	\$572.00

Additional Charges :

11/7/02	Filing Fee (provisional application)	80.00
<hr/>		<hr/>
Total costs		\$80.00
<hr/>		<hr/>
Total amount of this bill		\$652.00
<hr/>		<hr/>

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0006P**

Subject Matter: Patent Prosecution

Title: Multiple Channel Interference Cancellation

Serial No.: Not yet assigned

Professional Services

		Hrs/Rate	Amount
11/27/02	CWM	Draft e-mail to W. Jones attaching second draft of application	0.10 220.00/hr
		For professional services rendered	0.10
			\$22.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0007P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Bandwidth Enhancement of Transformers

Serial No.: Not yet assigned

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
11/27/02	CWM	0.10 220.00/hr	22.00
For professional services rendered		0.10	\$22.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0008P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Cancellation Using Mixed Signal Processing

Serial No.: Not yet assigned

Professional Services

			<u>Hrs/Rate</u>	<u>Amount</u>
11/20/02	CWM	Revise patent application	0.80 220.00/hr	176.00
11/21/02	CWM	Review and revise patent application	1.20 220.00/hr	264.00
11/22/02	CWM	Revise patent application based on comments inventors	5.20 220.00/hr	1,144.00
For professional services rendered			7.20	<hr/> \$1,584.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0011G**

Subject Matter: Patent Prosecution

Title: Receive Reshaper

Serial No.: Not yet assigned

Professional Services

		<u>Hrs/Rate</u>	<u>Amount</u>
11/1/02	CWM	5.40 220.00/hr	1,188.00
			<hr/>
For professional services rendered			5.40
			<hr/>
			\$1,188.00

Weide & Miller, Ltd.
330 South 3rd Street
Suite 1130
Las Vegas, NV 89101
Voice: 702-382-4804
Facsimile: 702-382-4805

Date Generated/Mailed: December 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.
9501 Jeronimo Road, Suite 100
Irvine CA 92618

In Reference To: Weide & Miller Ref. No.: SLRFLR.0001G
Subject Matter: General Intellectual Property Representation

New Fees	New Costs	Total New Charges
\$242.00	\$0.00	\$242.00

In Reference To: Weide & Miller Ref. No.: SLRFLR.0002P
Subject Matter: Patent Prosecution
Title: Method and Apparatus for Channel Equalization
Serial No.: 10/188,274

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: Weide & Miller Ref. No.: SLRFLR.0003P
Subject Matter: Patent Prosecution
Title: Communication System
Serial No.: 10/194,775

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0004P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$572.00	\$80.00	\$652.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0005P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Constellation Shaping

Serial No.: 10/194,741

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0006P**

Subject Matter: Patent Prosecution

Title: Multiple Channel Interference Cancellation

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$22.00	\$0.00	\$22.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0007P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Bandwidth Enhancement of Transformers

Serial No.: Not yet assigned

New Fees	New Costs	Total New Charges
\$22.00	\$0.00	\$22.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0008P**

Subject Matter: Patent Prosecution

Title: Method and Apparatus for Cancellation Using Mixed Signal Processing

Serial No.: Not yet assigned

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$1,584.00	\$0.00	\$1,584.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0010P**

Subject Matter: Patent Prosecution

Title: Transmit Reshaper

Serial No.: Not yet assigned

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0011G**

Subject Matter: Patent Prosecution

Title: Receive Reshaper

Serial No.: Not yet assigned

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$1,188.00	\$0.00	\$1,188.00

Summary For All Matters:

\$3,630.00	\$80.00	\$3,710.00
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GRAND TOTAL OF ALL AMOUNTS
DUE:

\$3,710.00

Selection Criteria

Slip.Date 9/1/2002 - 10/31/2002
Slip.Billed Yes
Slip.Billing Status Billable
Slip.Classification Open
Time.Selection Include: Chad W. Miller

Rate Info - identifies rate source and level

Slip ID		Timekeeper	Units	Rate	Slip Value
	Dates and Time	Activity	DNB Time	Rate Info	
	Posting Status	Client	Est. Time	Bill Status	
	Description	Reference	Variance		
10871	TIME 9/4/2002 Billed G:4614	Chad W. Miller Draft 10/6/2002 SLRFLR.0008P Continue draft patent application and create figures	3.40 0.00 0.00 0.00	220.00 T@1	748.00
10872	TIME 9/2/2002 Billed G:4614	Chad W. Miller Draft 10/6/2002 SLRFLR.0008P Draft patent application and create figures	4.30 0.00 0.00 0.00	220.00 T@1	946.00
10873	TIME 9/3/2002 Billed G:4492	Chad W. Miller Draft 10/3/2002 [REDACTED].0001G Draft billing estimate and provide same to K. DiMino	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10876	TIME 9/3/2002 Billed G:4460	Chad W. Miller Draft 9/25/2002 [REDACTED].0001G Update and send status reports	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10877	TIME 9/3/2002 Billed G:4597	Chad W. Miller Draft 10/6/2002 [REDACTED].0001G Update and send status reports	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10878	TIME 9/3/2002 Billed G:5386	Chad W. Miller Draft 12/8/2002 [REDACTED].0001G Update and send status reports	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10880	TIME 9/3/2002 Billed G:6206	Chad W. Miller Draft 3/12/2003 [REDACTED].0014P Revise application based on comments and draft additional claims; send same to K. Jones	2.30 0.00 0.00 0.00	220.00 T@1	506.00
10881	TIME 9/3/2002 Billed G:4614	Chad W. Miller Draft 10/6/2002 SLRFLR.0008P Review and revise application; draft figures relating to method of operation	2.80 0.00 0.00 0.00	220.00 T@1	616.00

3/29/2006
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Weide & Miller, Ltd.
Slip Listing

Page 2

Slip ID		Timekeeper	Units	Rate	Slip Value
	Dates and Time	Activity	DNB Time	Rate Info	
	Posting Status	Client	Est. Time		
	Description	Reference	Variance	Bill Status	
10882	TIME 9/6/2002 Billed	Chad W. Miller Conference G:4492 10/3/2002 [REDACTED] 0001G Conference with D. Nelson regarding status of applications; forward second copies of application in electronic form to inventors; review inventors comments	0.50 0.00 0.00 0.00	220.00 T@1	110.00
10883	TIME 9/6/2002 Billed	Chad W. Miller Conference G:4612 10/6/2002 SLRFLR.0006P Draft claims and draft portion of application relation to method of operation	5.70 0.00 0.00 0.00	220.00 T@1	1254.00
10884	TIME 9/7/2002 Billed	Chad W. Miller Conference G:4614 10/6/2002 SLRFLR.0008P Draft claims and draft portion of application relation to method of operation of mixed signal cancellation	4.30 0.00 0.00 0.00	220.00 T@1	946.00
10885	TIME 9/5/2002 Billed	Chad W. Miller Draft G:4607 10/6/2002 SLRFLR.0001G Update status report	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10886	TIME 9/5/2002 Billed	Chad W. Miller Conference G:4630 10/6/2002 [REDACTED] 0001G Prepare for meeting and general IP discussion during conference with T. Dreaper and M. Yin	0.40 0.00 0.00 0.00	220.00 T@1	88.00
10887	TIME 9/5/2002 Billed	Chad W. Miller Conference G:4636 10/6/2002 [REDACTED] 0008P Conference with inventors to obtain invention disclosure for Bacajack	1.10 0.00 0.00 0.00	220.00 T@1	242.00
10889	TIME 9/5/2002 Billed	Chad W. Miller Conference G:5198 11/17/2002 [REDACTED] 0004P Conference with T. Dreaper regarding prior art issues; conduct research and discuss same with RSW	0.40 0.00 0.00 0.00	220.00 T@1	88.00
10891	TIME 9/5/2002 Billed	Chad W. Miller Conference G:4633 10/6/2002 [REDACTED] 0005T Initiate preparation of trademark applications	0.20 0.00 0.00 0.00	220.00 T@1	44.00
10892	TIME 9/5/2002 Billed	Chad W. Miller Conference G:4635 10/6/2002 [REDACTED] 0007T Initiate preparation of trademark applications	0.20 0.00 0.00 0.00	220.00 T@1	44.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 3

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
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				Client	Est. Time	Bill Status	
				Reference	Variance		
10893	TIME 9/5/2002	Billed	G:4601 Draft letter enclosing maintenance fee transmittal	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10895	TIME 9/5/2002	Billed	G:4612 Draft text associated with method of operation figures and update figures	Chad W. Miller Draft	3.30 0.00 0.00 0.00	220.00 T@1	726.00
10930	TIME 9/13/2002	Billed	G:4613 Draft specification of patent application	Chad W. Miller Draft	5.70 0.00 0.00 0.00	220.00 T@1	1254.00
10933	TIME 9/13/2002	Billed	G:4544 Review and propose revisions to Response	Chad W. Miller Review	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10934	TIME 9/12/2002	Billed	G:4613 Draft specification and modify figures of patent application; draft description of figures	Chad W. Miller Draft	4.60 0.00 0.00 0.00	220.00 T@1	1012.00
10937	TIME 9/11/2002	Billed	G:4492 Conference call with K. DiMino; Draft e-mail to K. DiMino regarding request for copy of parent application; declarations and new reference number for case; review follow-up e-mail	Chad W. Miller Draft	0.40 0.00 0.00 0.00	220.00 T@1	88.00
10938	TIME 9/11/2002	Billed	G:4607 Draft e-mail to G. Zimmerman providing updated status report; update status report	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
10940	TIME 9/11/2002	Billed	G:4631 Review and revise application based on inventors' comments	Chad W. Miller Draft	1.80 0.00 0.00 0.00	220.00 T@1	396.00
10942	TIME 9/10/2002	Billed	G:6207 Conference with K. Jones to obtain invention disclosure; begin drafting patent application	Chad W. Miller Draft	6.40 0.00 0.00 0.00	220.00 T@1	1408.00

3/29/2006
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Slip Listing

Page 4

Slip ID Dates and Time Posting Status Description	TIME 9/10/2002 Billed G:4631	10/6/2002 Review changes proposed by inventors and initiate editing of application to achieve certain changes	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
10945			Chad W. Miller Draft	0.20 0.00	220.00 T@1	44.00
				0.00		
				0.00		
				0.00		
10946	TIME 9/9/2002 Billed G:4612	10/6/2002 Draft claims and send application to W. Jones via e-mail	Chad W. Miller Draft	4.80 0.00	220.00 T@1	1056.00
				0.00		
				0.00		
10947	TIME 9/9/2002 Billed G:4614	10/6/2002 Revise portion of application dealing with mixed signal cancellation	Chad W. Miller Draft	0.80 0.00	220.00 T@1	176.00
				0.00		
10948	TIME 9/9/2002 Billed G:4492	10/3/2002 Provide status of outstanding application to K. DiMino	Chad W. Miller Phone client	0.20 0.00	220.00 T@1	44.00
				0.00		
				0.00		
10949	TIME 9/9/2002 Billed G:4630	10/6/2002 Schedule upcoming conference	Chad W. Miller Phone client	0.10 0.00	220.00 T@1	22.00
				0.00		
				0.00		
11003	TIME 9/16/2002 Billed G:4613	10/6/2002 Draft patent application claims and abstract	Chad W. Miller Draft	5.70 0.00	220.00 T@1	1254.00
				0.00		
				0.00		
11004	TIME 9/16/2002 Billed G:5387	12/8/2002 Draft letter to K. Kind enclosing Filing Receipt; review same for accuracy	Chad W. Miller Draft	0.20 0.00	220.00 T@1	44.00
				0.00		
				0.00		
11006	TIME 9/17/2002 Billed G:4630	10/6/2002 Conference with M. Yin and T. Dreaper regarding various patent applications and trademarks; prepare for same	Chad W. Miller Conference	1.00 0.00	220.00 T@1	220.00
				0.00		
				0.00		
11007	TIME 9/17/2002 Billed G:4612	10/6/2002 Conference with B. Jones regarding patent application	Chad W. Miller Conference	0.70 0.00	220.00 T@1	154.00
				0.00		
				0.00		

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Slip Listing

Page 5

Slip ID		Timekeeper	Units	Rate	Slip Value
	Dates and Time	Activity	DNB Time	Rate Info	
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	Description	Reference	Variance		
11008	TIME 9/17/2002 Billed	Chad W. Miller Prep Pleadings 12/8/2002 [REDACTED].0012P	0.70 0.00 0.00 0.00	220.00 T@1	154.00
	Prepare formal papers; identify unconfirmed information; draft e-mail to R. Winder enclosing same				
11009	TIME 9/17/2002 Billed	Chad W. Miller Draft 12/8/2002 [REDACTED].0010P	0.10 0.00 0.00 0.00	220.00 T@1	22.00
	Draft letter to K. Kind enclosing published PCT patent application and Notice Informing Applicant of Communication to International Designated Offices				
11011	TIME 9/17/2002 Billed	Chad W. Miller Preparation 10/6/2002 [REDACTED].0005T	0.40 0.00 0.00 0.00	220.00 T@1	88.00
	Review trademark applications and research description of services				
11012	TIME 9/17/2002 Billed	Chad W. Miller Preparation 10/6/2002 [REDACTED].0006T	0.40 0.00 0.00 0.00	220.00 T@1	88.00
	Review trademark applications and research description of services				
11013	TIME 9/17/2002 Billed	Chad W. Miller Preparation 10/6/2002 [REDACTED].0007T	0.40 0.00 0.00 0.00	220.00 T@1	88.00
	Review trademark applications and research description of services				
11014	TIME 9/17/2002 Billed	Chad W. Miller Draft 10/6/2002 SLRFLR.0007P	1.30 0.00 0.00 0.00	220.00 T@1	286.00
	Revise portion of patent application; short conference call with inventor to verify terminology				
11015	TIME 9/15/2002 Billed	Chad W. Miller Draft 10/6/2002 SLRFLR.0007P	0.90 0.00 0.00 0.00	220.00 T@1	198.00
	Draft portion of application concerning Figures 7A and 7B; update Description of Figures				
11017	TIME 9/17/2002 Billed	Chad W. Miller Draft patent application 10/6/2002 [REDACTED].0008P	6.10 0.00 0.00 0.00	220.00 T@1	1342.00
	Continue drafting patent application specification.				
11018	TIME 9/18/2002 Billed	Chad W. Miller Draft patent application 10/6/2002 [REDACTED].0008P	4.10 0.00 0.00 0.00	220.00 T@1	902.00
	Draft patent application specification.				

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 6

Slip ID Dates and Time Posting Status Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11024 9/19/2002 Billed Review and revise patent application	Chad W. Miller Draft	4.10 0.00 0.00 0.00	220.00 T@1	902.00
11029 9/19/2002 Billed Conference with client to schedule disclosure meeting	Chad W. Miller Conference	0.50 0.00 0.00 0.00	220.00 T@1	110.00
11067 9/18/2002 Billed Review message from Examiner regarding restriction requirement; review claims and conduct conference with Examiner regarding election of claims; discuss nomination of invention and inventors for Innovators Award with Examiner	Chad W. Miller Review	1.30 0.00 0.00 0.00	220.00 T@1	286.00
11068 9/18/2002 Billed Review statement of goods for trademark applications; perform general trademark searching of BACA family; Perform additional searching after discovery of similar marks; discuss same with T. Dreaper; draft agreement for R. Conti; discuss same with T. Dreaper; discuss agreement with RSW; review Bacallete patent assignment document for requirements as it relates recordation at Patent Office	Chad W. Miller Review	3.60 0.00 0.00 0.00	220.00 T@1	792.00
11070 9/18/2002 Billed Draft letter to client enclosing publish PCT application	Chad W. Miller Correspondence	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11071 9/18/2002 Billed Schedule disclosure meeting with B. McClellan; review e-mail with attachments	Chad W. Miller Correspondence	0.50 0.00 0.00 0.00	220.00 T@1	110.00
11099 9/23/2002 Billed Draft letter to S. Warhola enclosing issued patent application; initiate proof read of patent	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11104 9/23/2002 Billed Update and send WIP report	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00

3/29/2006
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Weide & Miller, Ltd.
Slip Listing

Page 7

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11107	TIME 9/23/2002		Outline figures and application	Chad W. Miller Conference	0.40 0.00	220.00 T@1	88.00
	Billed G:5198				0.00		
		11/17/2002		████████0004P	0.00		
11108	TIME 9/23/2002		Draft e-mail regarding filing of Demand	Chad W. Miller Draft	0.10 0.00	220.00 T@1	22.00
	Billed G:6205				0.00		
		3/12/2003		████████0013P	0.00		
11109	TIME 9/24/2002		Read e-mail from R. Winder regarding filing of Demand	Chad W. Miller Draft	0.10 0.00	220.00 T@1	22.00
	Billed G:6205				0.00		
		3/12/2003		████████0013P	0.00		
11110	TIME 9/23/2002		Prepare for meeting by reviewing disclosures and researching subject matter of same	Chad W. Miller Research	0.70 0.00	220.00 T@1	154.00
	Billed G:6208				0.00		
		3/12/2003		████████0016P	0.00		
11115	TIME 9/24/2002		Conference with C. Chang to obtain invention disclosure	Chad W. Miller Conference	2.40 0.00	220.00 T@1	528.00
	Billed G:6208				0.00		
		3/12/2003		████████0016P	0.00		
11116	TIME 9/25/2002		Conference with B. McClellan to obtain invention disclosure; prepare for same by reviewing disclosure documents and portion of specification	Chad W. Miller Conference	5.30 0.00	220.00 T@1	1166.00
	Billed G:4616				0.00		
		10/6/2002		SLRFLR.0010P	0.00		
11117	TIME 9/25/2002		Conference with B. Jones regarding status of patent matters	Chad W. Miller Conference	0.20 0.00	220.00 T@1	44.00
	Billed G:4607				0.00		
		10/6/2002		SLRFLR.0001G	0.00		
11118	TIME 9/25/2002		Conference with inventors regarding status and to discuss one aspect of invention	Chad W. Miller Conference	0.30 0.00	220.00 T@1	66.00
	Billed G:4613				0.00		
		10/6/2002		SLRFLR.0007P	0.00		
11119	TIME 9/20/2002		Revise patent application; revise figures	Chad W. Miller Revise	5.20 0.00	220.00 T@1	1144.00
	Billed G:4636				0.00		
		10/6/2002		████████0008P	0.00		

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	Description	Reference	Variance		
11151	TIME	Chad W. Miller	1.70	220.00	374.00
	9/29/2002	Draft	0.00	T@1	
	Billed G:6207	3/12/2003 [REDACTED].0015P	0.00		
	Draft patent application and create figures		0.00		
11152	TIME	Chad W. Miller	0.30	220.00	66.00
	9/26/2002	Conference	0.00	T@1	
	Billed G:4630	10/6/2002 [REDACTED].0001G	0.00		
	Conference with M. Vince at Gaming Control Board to discuss status of information request; draft letter to M. Vince to enclose reports		0.00		
11153	TIME	Chad W. Miller	0.10	220.00	22.00
	9/26/2002	Draft	0.00	T@1	
	Billed G:5394	12/8/2002 [REDACTED].0010P	0.00		
	Draft letter to K. Kind enclosing copy of proof of Receipt of Demand		0.00		
11155	TIME	Chad W. Miller	1.80	220.00	396.00
	9/26/2002	Draft	0.00	T@1	
	Billed G:6207	3/12/2003 [REDACTED].0015P	0.00		
	Draft patent application; review disclosure notes		0.00		
11162	TIME	Chad W. Miller	0.20	220.00	44.00
	9/27/2002	Conference	0.00	T@1	
	Billed G:5390	12/8/2002 [REDACTED].0005P	0.00		
	Conference with K. Hale regarding restriction requirement and filing of divisional application; review and respond to e-mail from R. Winder		0.00		
11163	TIME	Chad W. Miller	0.20	220.00	44.00
	9/27/2002	Draft	0.00	T@1	
	Billed G:4630	10/6/2002 [REDACTED].0001G	0.00		
	Draft letter to T. Dreaper enclosing letters to records departments; send letter to M. Vince; schedule meeting to discuss application		0.00		
11167	TIME	Chad W. Miller	5.90	220.00	1298.00
	9/27/2002	Draft	0.00	T@1	
	Billed G:6207	3/12/2003 [REDACTED].0015P	0.00		
	Draft application; review parent to insure proper incorporation; short conference with K. Jones		0.00		
11168	TIME	Chad W. Miller	1.00	220.00	220.00
	9/26/2002	File with USPTO	0.00	T@1	
	Billed G:4631	10/6/2002 [REDACTED].0002P	0.00		
	Prepare transmittal and assignment recordation cover sheet; file patent application with USPTO		0.00		
11169	EXP	Chad W. Miller	1	589.00	589.00
	9/26/2002	Filing Fee			
	Billed G:4631	10/6/2002 [REDACTED].0002P			
	U.S. PTO Filing Fee (small entity)				

Slip ID Dates and Time Posting Status Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11170 EXP 9/26/2002 Billed G:4631 Assignment Recordation Fee	Chad W. Miller Filing Fee ████████0002P	1	40.00	40.00
11187 TIME 9/17/2002 Billed G:4492 Meet with various inventors at G2E gaming show and discuss various aspects of new products.	Chad W. Miller Meeting ████████0001G	1.00 0.00 0.00 0.00	220.00 T@1	220.00
11188 TIME 10/2/2002 Billed G:5114 Review and revise patent application	Chad W. Miller Draft 11/5/2002 SLRFLR.0007P	4.80 0.00 0.00 0.00	220.00 T@1	1056.00
11189 TIME 10/2/2002 Billed G:5163 Review and revise status report; draft and send letter enclosing application	Chad W. Miller Draft 11/10/2002 █████.0001G	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11190 TIME 10/2/2002 Billed G:5065 Conference with RSW regarding options to deal with game show and new magazine	Chad W. Miller Conference 11/1/2002 █████.0000G	0.20 0.00 0.00 0.00	190.00 C@1	38.00
11191 TIME 10/2/2002 Billed G:6205 Prepare and file Demand	Chad W. Miller Draft 3/12/2003 █████.0013P	1.60 0.00 0.00 0.00	220.00 T@1	352.00
11192 TIME 10/1/2002 Billed G:5386 Update and send status report	Chad W. Miller Draft 12/8/2002 █████.0001G	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11193 TIME 10/1/2002 Billed G:5109 Update and send status report	Chad W. Miller Draft 11/5/2002 SLRFLR.0001G	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11194 TIME 10/1/2002 Billed G:4597 Update and send status report	Chad W. Miller Draft 10/6/2002 █████.0001G	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11195 TIME 10/1/2002 Billed G:6207 Draft claims and review prior art article provided by inventors	Chad W. Miller Draft 3/12/2003 █████.0015P	2.40 0.00 0.00 0.00	220.00 T@1	528.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 10

Slip ID Dates and Time Posting Status Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11196 TIME 10/1/2002 Billed G:4601 10/6/2002 Review facsimile from D. Sheffey and create Maintenance Fee Status Report	Chad W. Miller Draft ████████.0001G	1.10 0.00 0.00 0.00	220.00 T@1	242.00
11197 TIME 10/1/2002 Billed G:5196 11/17/2002 Conference discussing trademark options, other patents and corporate actions	Chad W. Miller Conference ████████.0001G	0.90 0.00 0.00 0.00	220.00 T@1	198.00
11198 TIME 10/1/2002 Billed G:5201 11/17/2002 Conference to discuss changes to patent application	Chad W. Miller Conference ████████.0008P	1.60 0.00 0.00 0.00	220.00 T@1	352.00
11199 TIME 9/30/2002 Billed G:11371 7/13/2004 Conference with D. Brass and A. Vadjinia regarding status of cases	Chad W. Miller Conference ████████.0001G	0.40 0.00 0.00 0.00	220.00 T@1	88.00
11200 TIME 10/1/2002 Billed G:5343 12/8/2002 Conference with RSW regarding examiner's rejection; review Office Action and Application	Chad W. Miller Conference ████████.0001P	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11201 TIME 9/30/2002 Billed G:4601 10/6/2002 Conference with D. Sheffey to discuss maintenance fee notice	Chad W. Miller Conference ████████.0001G	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11202 TIME 9/30/2002 Billed G:5390 12/8/2002 Conference with Examiner regarding modification to restriction requirement	Chad W. Miller Conference ████████.0005P	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11203 TIME 9/30/2002 Billed G:6207 3/12/2003 Draft patent application	Chad W. Miller Draft ████████.0015P	4.70 0.00 0.00 0.00	220.00 T@1	1034.00
11254 TIME 10/3/2002 Billed G:5163 11/10/2002 Prepare estimate of Sept. invoice and e-mail same to K. DiMino	Chad W. Miller Draft ████████.0001G	0.10 0.00 0.00 0.00	220.00 T@1	22.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 11

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11255	TIME 10/3/2002	Billed	G:5196 Research current rules regarding trademark cancellation proceedings and discuss same with RSW	Chad W. Miller Research	0.40 0.00 0.00 0.00	220.00 T@1	88.00
11256	TIME 10/3/2002	Billed	G:5392 Draft letter enclosing Notice of Recordation of Assignments; review same for accuracy	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11257	TIME 10/3/2002	Billed	G:5110 Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11258	TIME 10/3/2002	Billed	G:5111 Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11259	TIME 10/3/2002	Billed	G:5112 Draft letter enclosing Notice of Recordation of Assignments; review same for accuracy	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11263	TIME 10/3/2002	Billed	G:6205 Draft letter enclosing Demand that was filed with Patent Office	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11264	TIME 10/3/2002	Billed	G:5388 Draft letter enclosing Notice of Publication of Application and copy of published application	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11265	TIME 10/3/2002	Billed	G:5156 Draft letter enclosing Notice of Publication of Application	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11266	TIME 10/3/2002	Billed	G:5161 Revise and re-file with U.S. Patent Office a Request for Change of Address	Chad W. Miller Draft	0.30 0.00 0.00 0.00	220.00 T@1	66.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 12

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11267	TIME 10/3/2002	Billed G:5116	Outline specification and outline figures	Chad W. Miller Draft	4.30 0.00	220.00 T@1	946.00
11268	TIME 10/4/2002	Billed G:5116	Draft background section and outline figures	Chad W. Miller Draft	1.20 0.00	220.00 T@1	264.00
11269	TIME 10/3/2002	Billed G:5160	Draft separate reminders for upcoming maintenance fees; delegate finalization of same to assistant	Chad W. Miller Draft	0.60 0.00	220.00 T@1	132.00
11270	TIME 10/7/2002	Billed G:5158	Review Office Action and prior art; create notes regarding potential arguments in favor of allowability; draft e-mail to and call and leave message with inventor (N. Beamish) to obtain input; call Foreign Associate and leave message	Chad W. Miller Review	2.80 0.00	220.00 T@1	616.00
11271	TIME 10/7/2002	Billed G:5162	Review letter from Foreign Associate (Borden, Ladner, and Gervais) regarding maintenance fee; draft letter to D. Sheffey enclosing copy of same	Chad W. Miller Review	0.30 0.00	220.00 T@1	66.00
11315	TIME 10/13/2002	Billed G:5114	Review and revise figures; supplement application	Chad W. Miller Draft	3.90 0.00	220.00 T@1	858.00
11317	TIME 10/10/2002	Billed G:5201	Review and revise application; send same to T. Dreaper	Chad W. Miller Draft	1.10 0.00	220.00 T@1	242.00
11318	TIME 10/10/2002	Billed G:5384	Review and revise application to insure that all changes were made and proper draft being sent; send same to D. Huffaker	Chad W. Miller Draft	1.10 0.00	220.00 T@1	242.00
11320	TIME 10/9/2002	Billed G:5159	Review e-mails from T. McEwan and client's prior law firm regarding transfer of files; short conversation with Sue from prior law firm; initiate preparation of	Chad W. Miller Review	0.90 0.00	220.00 T@1	198.00

Slip ID Dates and Time Posting Status Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value	
assignments					
11322 10/9/2002 Billed	TIME G:5160 Draft letter to D. Sheffey regarding prior allegation of infringement	Chad W. Miller Draft 11/6/2002 [REDACTED] 0001G	0.30 0.00 0.00 0.00	220.00 T@1	66.00
11326 10/9/2002 Billed	TIME G:5116 Review disclosure notes; create figures; outline application	Chad W. Miller Review 11/5/2002 SLRFLR.0010P	2.60 0.00 0.00 0.00	220.00 T@1	572.00
11329 10/8/2002 Billed	TIME G:5116 Draft background section; create figures	Chad W. Miller Review 11/5/2002 SLRFLR.0010P	3.30 0.00 0.00 0.00	220.00 T@1	726.00
11330 10/8/2002 Billed	TIME G:5306 Discuss search results with RSW	Chad W. Miller Review 12/5/2002 [REDACTED] 0001P	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11356 10/15/2002 Billed	TIME G:5116 Draft patent application	Chad W. Miller Draft 11/5/2002 SLRFLR.0010P	5.40 0.00 0.00 0.00	220.00 T@1	1188.00
11357 10/15/2002 Billed	TIME G:5163 Oversee review of files to ascertain which cases were assigned to International Game Technology; initiate preparation of assignments	Chad W. Miller Draft 11/10/2002 [REDACTED] 0001G	1.80 0.00 0.00 0.00	220.00 T@1	396.00
11358 10/15/2002 Billed	TIME G:5160 Conference call with D. Sheffey to discuss potential infringement matter	Chad W. Miller Conference 11/6/2002 [REDACTED] 0001G	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11360 10/14/2002 Billed	TIME G:5197 Draft letter enclosing post card evidencing filing date and serial number of application	Chad W. Miller Conference 11/17/2002 [REDACTED] 0002P	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11361 10/14/2002 Billed	TIME G:5156 Draft letter enclosing issued patent; initiate proofreading of claims	Chad W. Miller Draft 11/5/2002 [REDACTED] 0002P	0.30 0.00 0.00 0.00	220.00 T@1	66.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
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Page 14

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				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11362	TIME 10/14/2002	Billed G:5161	Draft letter enclosing Request for Change of Address	Chad W. Miller Draft	0.20 0.00	220.00 T@1	44.00
11363	TIME 10/14/2002	Billed G:5159	Review facsimile from Nick M.; review and revise assignment documents and Schedule A	Chad W. Miller Draft	1.40 0.00	220.00 T@1	308.00
11364	TIME 10/14/2002	Billed G:5116	Draft figures and patent application; review disclosure tape	Chad W. Miller Draft	3.60 0.00	220.00 T@1	792.00
11379	TIME 10/18/2002	Billed G:5196	Conference with client regarding trademark matters, outstanding patent matters and other intellectual property issues, including trademark cancellation proceedings	Chad W. Miller Conference	0.80 0.00	220.00 T@1	176.00
11380	TIME 10/18/2002	Billed G:5201	Conference with client regarding changes to patent application	Chad W. Miller Conference	1.10 0.00	220.00 T@1	242.00
11382	TIME 10/18/2002	Billed G:5116	Draft patent application	Chad W. Miller Draft	2.80 0.00	220.00 T@1	616.00
11383	TIME 10/18/2002	Billed G:5198	Revise first draft of patent application	Chad W. Miller Draft	0.70 0.00	220.00 T@1	154.00
11384	TIME 10/17/2002	Billed G:5198	Continue drafting patent application	Chad W. Miller Draft	5.80 0.00	220.00 T@1	1276.00
11386	TIME 10/17/2002	Billed G:5159	Short conference with T. McEwan; review and revise assignment documents and add foreign cases to Schedule A	Chad W. Miller Draft	0.40 0.00	220.00 T@1	88.00

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11388	TIME 10/16/2002	Billed G:5198	Draft patent application	Chad W. Miller Draft	5.40 0.00 0.00 0.00	220.00 T@1	1188.00
11389	TIME 10/16/2002	Billed G:5386	Review e-mail from R. Winder and respond to same; obtain requested documents	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11390	TIME 10/16/2002	Billed G:5163	Review Schedule A, assignments and propose revisions; draft letter to L. Van Asdale enclosing same	Chad W. Miller Draft	1.20 0.00 0.00 0.00	220.00 T@1	264.00
11392	TIME 10/16/2002	Billed G:5159	Review and revise Schedule A and Assignment	Chad W. Miller Research	0.60 0.00 0.00 0.00	220.00 T@1	132.00
11413	TIME 10/20/2002	Billed G:5116	Review e-mail with attachments from B. McCellan; select figure from attachments for use in application; draft application	Chad W. Miller Draft	1.60 0.00 0.00 0.00	220.00 T@1	352.00
11414	EXP 10/2/2002	Billed Demand Fee	G:6205	Chad W. Miller Filing Fee	1	636.00	636.00
11456	TIME 10/21/2002	Billed G:5117	Draft patent application	Chad W. Miller Draft	1.80 0.00 0.00 0.00	220.00 T@1	396.00
11457	TIME 10/24/2002	Billed G:5201	Revise patent application based on inventor's comments; create new figure 1B	Chad W. Miller Draft	1.70 0.00 0.00 0.00	220.00 T@1	374.00
11458	TIME 10/24/2002	Billed G:5116	Draft portion of patent application dealing with receiver	Chad W. Miller Draft	1.10 0.00 0.00 0.00	220.00 T@1	242.00
11461	TIME 10/25/2002	Billed G:5201	Revise Figure 1B	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 16

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11463	TIME 10/25/2002	Billed G:5158	11/5/2002 Conference call with Foreign Associate regarding upcoming response due date; discuss Examiner's Office Action	Chad W. Miller Draft	0.30 0.00	220.00 T@1	66.00
11465	TIME 10/25/2002	Billed G:5196	11/17/2002 Investigate status of Bacalette trademark application; discuss same with T. Dreaper	Chad W. Miller Conference	0.50 0.00	220.00 T@1	110.00
11466	TIME 10/25/2002	Billed G:5159	11/6/2002 Review assignment recordation documents; review assignment; conference with T. McEwan regarding incorrect date; prepare Fed. Ex. to client returning assignment and providing new assignment	Chad W. Miller Conference	0.50 0.00	220.00 T@1	110.00
11467	TIME 10/25/2002	Billed G:5157	11/5/2002 Prepare and file Request for Status	Chad W. Miller Draft	0.20 0.00	220.00 T@1	44.00
11468	TIME 10/25/2002	Billed G:5111	11/5/2002 Prepare Information Disclosure Statement and file same with Patent Office	Chad W. Miller Draft	0.90 0.00	220.00 T@1	198.00
11469	TIME 10/28/2002	Billed G:5158	11/5/2002 Call S. Torri to obtain inventor contact information; conference call with inventor N. Beamish regarding examination; draft letter with enclosures to inventor; review prior art and application to distinguish prior art; draft letter to Foreign Associate regarding inventor comments	Chad W. Miller Draft	1.20 0.00	220.00 T@1	264.00
11474	TIME 10/28/2002	Billed G:5392	12/8/2002 Prepare Information Disclosure Statement	Chad W. Miller Draft	0.50 0.00	220.00 T@1	110.00
11475	TIME 10/28/2002	Billed G:5157	11/5/2002 Draft and send letter to S. Warhola enclosing Request for Status	Chad W. Miller Draft	0.10 0.00	220.00 T@1	22.00
11476	TIME 10/28/2002	Billed G:5111	11/5/2002 SLRFLR.0003P	Chad W. Miller Draft	0.10 0.00	220.00 T@1	22.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 17

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client Reference	Est. Time	Bill Status	
	Draft and send letter to W. Jones enclosing Information Disclosure Statement that was filed with Patent Office				0.00		
11478	10/28/2002	Billed	TIME G:5395	Chad W. Miller File with USPTO 12/8/2002 [REDACTED].0011P	1.10 0.00 0.00 0.00	220.00 T@1	242.00
			Prepare transmittal and file application with Patent Office				
11479	10/28/2002	Billed	TIME G:5396	Chad W. Miller File with USPTO 12/8/2002 [REDACTED].0012P	0.90 0.00 0.00 0.00	220.00 T@1	198.00
			Prepare transmittal and file application with Patent Office				
11480	10/28/2002	Billed	TIME G:5117	Chad W. Miller Draft 11/5/2002 SLRFLR.0011P	0.40 0.00 0.00 0.00	220.00 T@1	88.00
			Draft patent application				
11481	10/25/2002	Billed	TIME G:5395	Chad W. Miller Draft 12/8/2002 [REDACTED].0011P	0.30 0.00 0.00 0.00	220.00 T@1	66.00
			Revise application based on comments from K. Kind; review facsimile and e-mail regarding same				
11484	10/28/2002	Billed	EXP G:5395	Chad W. Miller Filing Fee 12/8/2002 [REDACTED].0011P	1	1226.00	1226.00
			U.S. Patent and Trademark Office Filing Fee				
11485	10/28/2002	Billed	EXP G:5395	Chad W. Miller Filing Fee 12/8/2002 [REDACTED].0011P	1	40.00	40.00
			U.S. Patent and Trademark Office Assignment Recordation Fee				
11502	10/29/2002	Billed	TIME G:5160	Chad W. Miller File Review 11/6/2002 [REDACTED].0001G	0.30 0.00 0.00 0.00	220.00 T@1	66.00
			Review bill from Foreign Associate; initiate investigation of same; draft letter to D. Sheffey enclosing same and await results of investigation				
11504	10/29/2002	Billed	TIME G:6470	Chad W. Miller File Review 4/6/2003 [REDACTED].0005P	0.10 0.00 0.00 0.00	220.00 T@1	22.00
			Review Response to Status Inquiry				
11505	10/30/2002	Billed	TIME G:6470	Chad W. Miller File Review 4/6/2003 [REDACTED].0005P	0.10 0.00 0.00 0.00	220.00 T@1	22.00
			Draft letter to client enclosing Response to Status Inquiry				

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 18

Slip ID Dates and Time Posting Status Description	TIME	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11508 10/29/2002 Billed	G:6205 Review Notice Regarding Communication of International Application to Designated Offices	Chad W. Miller Review 3/12/2003 [REDACTED].0013P	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11509 10/29/2002 Billed	G:5390 Review Office Action and draft letter to K. Kind enclosing same	Chad W. Miller Review 12/8/2002 [REDACTED].0005P	0.40 0.00 0.00 0.00	220.00 T@1	88.00
11510 10/29/2002 Billed	G:5386 Update Mindspeed Status Report provided by R. Winder; e-mail same to R. Winder	Chad W. Miller Review 12/8/2002 [REDACTED].0001G	0.30 0.00 0.00 0.00	220.00 T@1	66.00
11511 10/29/2002 Billed	G:5158 Conference with N. Beamish regarding his review of prior art and Examiner's statements	Chad W. Miller Conference 11/5/2002 [REDACTED].0004P	0.30 0.00 0.00 0.00	220.00 T@1	66.00
11512 10/29/2002 Billed	G:5117 Draft portion of application dealing with receive reshaper	Chad W. Miller Draft 11/5/2002 SLRFLR.0011P	2.30 0.00 0.00 0.00	220.00 T@1	506.00
11518 10/29/2002 Billed	G:5110 Draft letter enclosing Corrected Filing Receipt and review same for accuracy	Chad W. Miller Draft 11/5/2002 SLRFLR.0002P	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11531 10/30/2002 Billed	G:5159 Review, revise and file eleven assignments and requests for recordation with USPTO; prepare transmittal for eleven recordations; discuss same with P. Nelson	Chad W. Miller File with USPTO 11/6/2002 [REDACTED].0001G	2.40 0.00 0.00 0.00	220.00 T@1	528.00
11532 10/30/2002 Billed	G:5159 Draft letter to M. Haynes regarding receipt of files; initiate verification that all files listed on status report were received; review status reports to determine which files were transferred to Weide & Miller and which were sent to T. McEwan; designate client code assignment plan	Chad W. Miller Draft 11/6/2002 [REDACTED].0001G	0.60 0.00 0.00 0.00	220.00 T@1	132.00

Slip ID Dates and Time Posting Status Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11533 TIME 10/30/2002 Billed G:5395 12/8/2002 [REDACTED] .0011P Draft letter to K. Kind enclosing filed patent application	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11534 TIME 10/30/2002 Billed G:5396 12/8/2002 [REDACTED] .0012P Draft letter to K. Kind enclosing filed patent application	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11535 TIME 10/30/2002 Billed G:5117 11/5/2002 SLRFLR.0011P Create new figures; draft portion of application dealing with new figures and review last part of disclosure tape	Chad W. Miller Draft	2.80 0.00 0.00 0.00	220.00 T@1	616.00
11536 EXP 10/30/2002 Billed G:5159 11/6/2002 [REDACTED] .0001G Recording Fee paid to U.S. Patent and Trademark Office for eleven assignments (paid via deposit account)	Chad W. Miller Recording Fee	1	440.00	440.00
11537 EXP 10/31/2002 Billed G:5159 11/6/2002 [REDACTED] .0001G Recording Fee paid to U.S. Patent and Trademark Office for eleven assignments (paid via deposit account)	Chad W. Miller Recording Fee	1	440.00	440.00
11538 TIME 10/31/2002 Billed G:5159 11/6/2002 [REDACTED] .0001G Review, revise and file eleven assignments and requests for recordation with USPTO; prepare transmittal for eleven recordations; discuss same with P. Nelson	Chad W. Miller File with USPTO	2.20 0.00 0.00 0.00	220.00 T@1	484.00
11539 TIME 10/31/2002 Billed G:5159 11/6/2002 [REDACTED] .0001G Conference with T. McEwan regarding filed assignment documents; power of attorney documents; and license and litigation status; delegate P. Nelson to investigate all foreign cases for future assignments; initiate preparation of power of attorney documents	Chad W. Miller Conference	0.60 0.00 0.00 0.00	220.00 T@1	132.00
11540 TIME 10/31/2002 Billed G:5117 11/5/2002 SLRFLR.0011P Draft patent application	Chad W. Miller Draft	1.40 0.00 0.00 0.00	220.00 T@1	308.00

3/29/2006
11:17 AM

Weide & Miller, Ltd.
Slip Listing

Page 20

Slip ID	Dates and Time	Posting Status	Description	Timekeeper	Units	Rate	Slip Value
				Activity	DNB Time	Rate Info	
				Client	Est. Time	Bill Status	
				Reference	Variance		
11541	TIME 10/31/2002	Billed	G:5196 Discuss general IP matters including trademark status, other trademark users, including Mr. Silva, and use of patent pending designation on promotional material	Chad W. Miller Conference	0.80 0.00 0.00 0.00	220.00 T@1	176.00
11543	TIME 10/31/2002	Billed	G:5198 Discuss changes to patent application during conference with T. Dreaper and M. Yin	Chad W. Miller Conference	1.40 0.00 0.00 0.00	220.00 T@1	308.00
11544	TIME 10/31/2002	Billed	G:5199 Draft letter to T. Dreaper enclosing trademark application; review trademark application for accuracy prior to sending to client	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11545	TIME 10/31/2002	Billed	G:5200 Draft letter to T. Dreaper enclosing trademark application; review trademark application for accuracy prior to sending to client	Chad W. Miller Draft	0.20 0.00 0.00 0.00	220.00 T@1	44.00
11564	TIME 10/15/2002	Billed	G:5114 Draft letter sending application to inventors	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
11578	TIME 10/1/2002	Billed	G:5155 Update and send status report	Chad W. Miller Draft	0.10 0.00 0.00 0.00	220.00 T@1	22.00
Grand Total				Billable	219.40		51673.00
				Unbillable	0.00		0.00
				Total	219.40		51673.00

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